Heating and Ventilating

For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning

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THIS MONTH'S COVER

The Westchester County Office Building, White Plains, N. Y., has the distinction of being the first completely air conditioned office building in the East, since its plant was placed in service a few months before that of a large insurance company's building described on these pages some months ago. Morris and O'Connor were the architects, Daniel and Wallen the consulting engineers, and Hauxwell and Smith the heating and air conditioning contractors.

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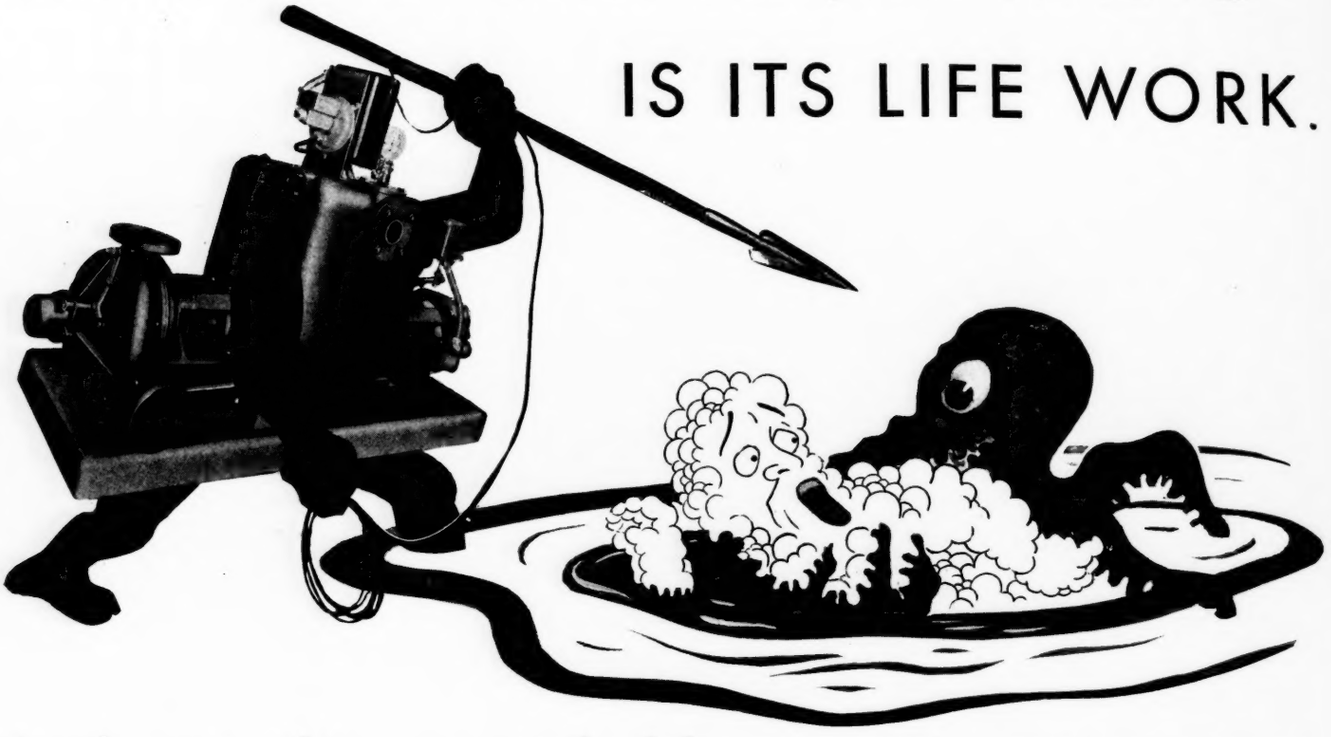
SAVING STEAM FROM WASTE IS ITS LIFE WORK.



And yet this remarkable new Heating Pump requires no electric current.

The reason the New Jennings Vapor Turbine needs no electric current is because it is driven by a special Vapor Turbine which functions on a differential of only 5 in. of mercury. It works equally well on any type of heating system, regardless of whether it is run above or below atmosphere. And it is mighty economical, because the steam that operates the Vapor Turbine passes right back to the heating system with practically no heat loss. If you would like the exact figure, the heat given up by the steam in operating the turbine is 7/8ths of 1% of the heat in the steam.

Now electric current, as every engineer knows, is the one biggest cost item in the operation of a vacuum heating pump. Cutting that out would be a big job, even if the pump, with the turbine, consumed a little more steam. But the wonderful thing about this pump is that it doesn't! It operates on steam, and yet it actually saves steam as compared with electric driven pumps of the same capacity. This saving in steam is reflected in a marked decrease in fuel consumption reported by users of this new pump.

Any engineer will appreciate how it saves steam when we say that it is a highly perfected pumping device operating continuously, because it can operate continuously with economy. Continuous operation means continuous removal of air and condensate, i.e., the maintenance of uniform conditions in the return line. And uniform circulation means steam saving.

We could tell you of many other ways in which the Vapor Turbine is economical. Cost of lubrication and maintenance is practically nothing. Little floor space is required. No expert attendance is needed.

But why don't you send for Bulletin 203 and learn all about this new way of keeping every radiator at top-notch heating efficiency, and with economy.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

Air Conditioning Modernization Rents Long Untenanted Space

Chicago Architectural Photographing Co.

Fig. 1. Chicago's Morton Building, adjoining the Elevated

AIR conditioning has reached a point where it offers a marked competitive advantage in rental of office and factory space. This is true even when air conditioning must be installed in existing buildings, and is confined to definite limits. Check-ups show that employee efficiency does improve, even when air control involves no more than good circulation with slightly positive pressure.

Many air conditioning systems have been installed by the lessees of office space and operating costs are not compiled from accurate data. It thus happens that costs are sometimes reported too low in favorable situations where power or cooling comes from central plants and is not directly metered and accounted for, and too high costs are reported from highly specialized installations of non-standardized equipment.

One examines with interest, therefore, an installation where a properly engineered system has been put in, where initial costs have been kept well in hand, where the entire occupied space is air-conditioned as a single unit, and where accurate cost records are kept to test the value of air conditioning in stimulating rentals. The air conditioning plant here described secured at once a long-term lease for the entire second floor space of a building. This floor, with 14,000 sq. ft. of floor space, has been untenanted since 1926.

The Morton Building is a well-built, carefully-managed building devoted to commercial offices and stores in the Chicago Loop district. Unfortunately, the second floor is flush with elevated train levels, and noisy surface cars traverse the side and front of building and intersect at corners. The room intensities of these outside noises were duly measured by engineers. The requirements of the incoming tenants were such that noise levels at information desk, sales department, and machine room should not exceed the readings shown in similar situations in the much more favorable location formerly occupied in another building.

In the second floor space of the building, the noise intensity averaged 20 to 30 decibels higher than the minimum requirement set. Noises within the room were about 15 decibels higher with open windows, and loudness of noises rose 35 decibels when fast elevated trains went by. Surface car noises rose 25 decibels with cars in motion.

It thus became a necessity to introduce measures of sound control, which has been accomplished by extensive application of sound absorbent material to the ceiling. Correction of extraneous noises indicated air conditioning, since all outside openings had to be kept closed.

The air conditioning installation finally installed is arranged for manual control by the occupants of the rooms, but no regulation on the part of tenants has been called for.

In general, the complete system consists of an air conditioner for humidifying and dehumidifying the air required, a supply fan, a preheater, a reheater for maintaining the proper temperature indoors, and automatic temperature control equipment. All are housed in the northwest corner of the second floor. The 30-ton refrigerating unit is located in the basement and has

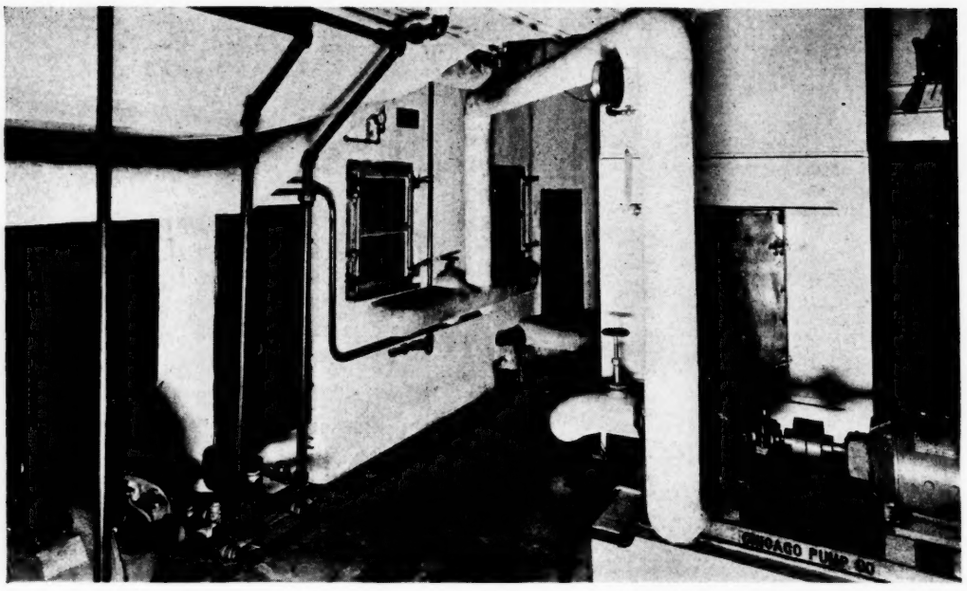


Fig. 2. Air conditioning machinery room, Morton Building

excess capacity for possible further extension of air cooling to other floors of the building.

The refrigeration plant is a complete carbonic anhydride safety system connected by means of supply and return piping to cooling coils placed within the air conditioner in fan room on the second floor. Air supply from two fans delivers at the rate of 15,200 c.f.m. of conditioned air to the conditioned space. This provides a complete change of air every 9 min. Air distribution is effected by means of overhead ducts at ceiling. There is a gradual downward diffusion of the conditioned air. Exhaust grilles are located at floor level. The exhaust fan is located in the fan room at the northwestern portion of the second floor.

Outside air is taken into the system at a point 22 ft. above the ground, and is filtered through a water spray. Operating conditions maintain a maximum temperature indoors of 80° in extreme hot weather.

The net result is a sound-controlled and air-conditioned space representing an installation outlay of slightly over 47 cents per sq. ft. of rented floor space. The plant has not been in stabilized operation long enough to give actual operation costs over the full period of a year, but experience to date shows approximately 9.3 cents per sq. ft. annually.

The office manager for the tenant, the Burroughs Adding Machine Company, reports a 20% increase of efficiency on the part of the working staff, and states

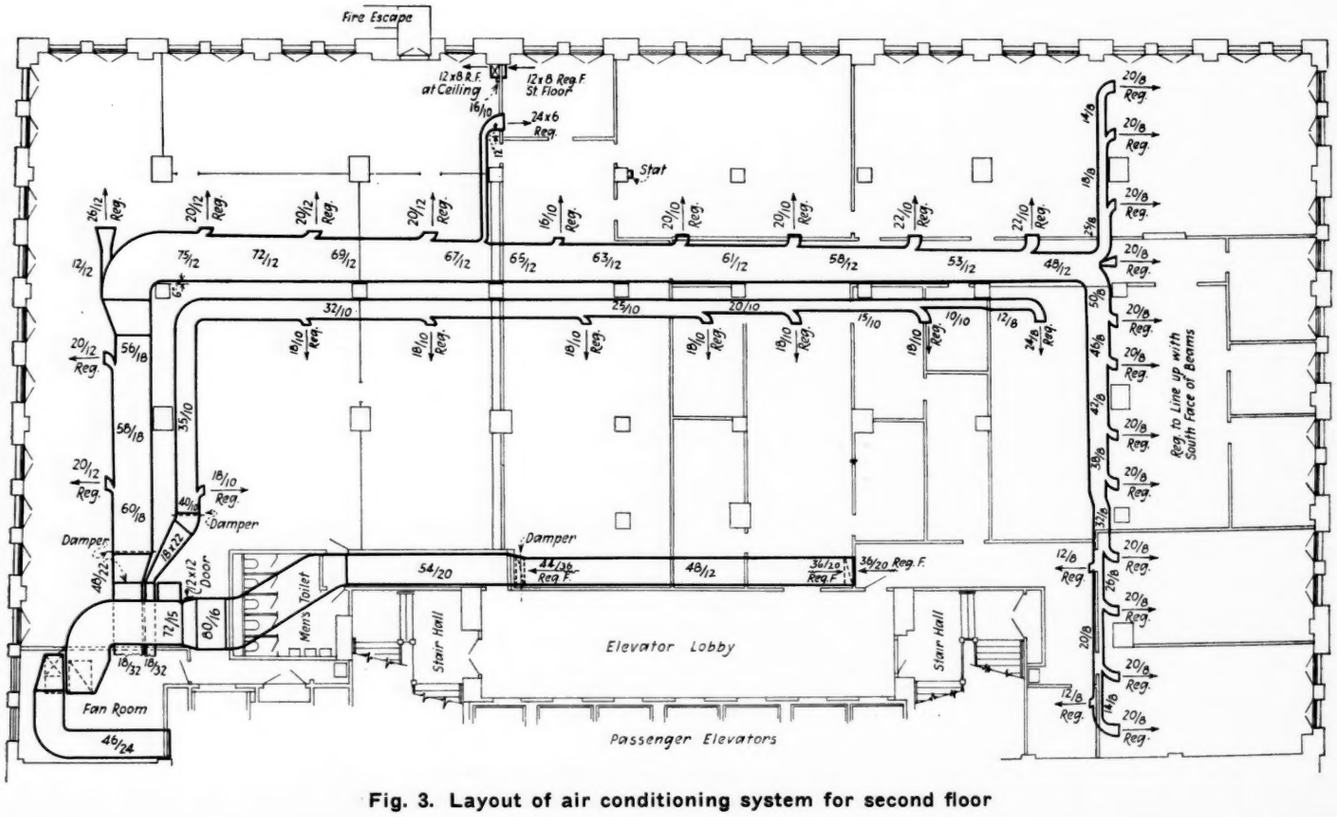


Fig. 3. Layout of air conditioning system for second floor

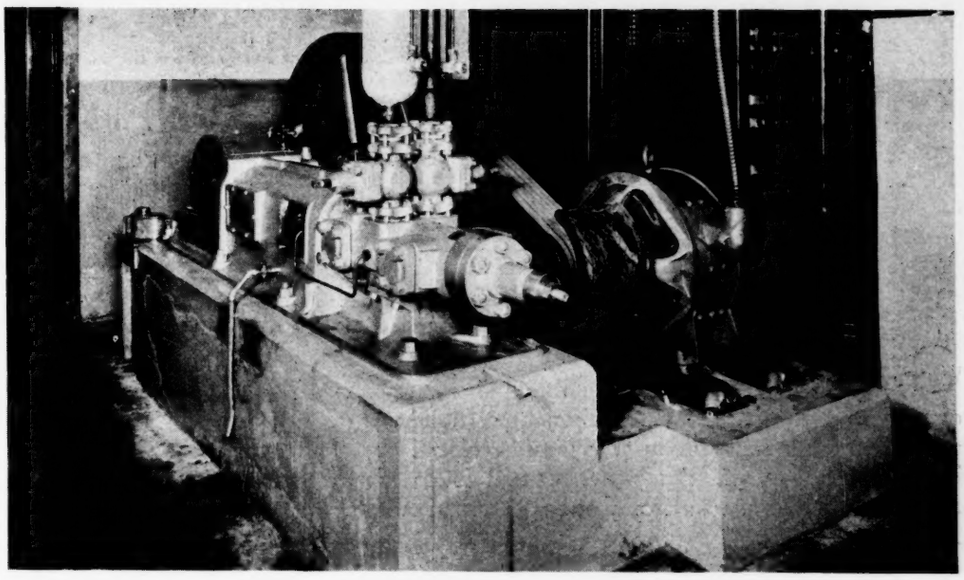


Fig. 4. Refrigerating machine for cooling second floor of Morton Building

that "All felt a willingness to work through thick and thin throughout the unusual heat and humidity of June, July, and August of an unusually hot summer. On occasions of salesmen's conventions, with intensive smoking continuously in narrow, closed quarters, the air remains always fresh and pleasant."

The system was designed by George Hubbard, mechanical engineer for Graham, Anderson, Probst & White, architects, and installed by the Kroeschell Engineering Company. E. C. Paine, manager of the building, is in charge of the operation of the conditioning plant.

Concentrated Heat

ADVANTAGES such as those which hot-water heating provides for numerous purposes may now become available at temperatures up to more than 1500°, as a result of the development of an improved inorganic liquid heat-carrier known as "NS fluid." Water can be kept from vaporizing only up to 706°, and then only by tremendous pressure. Diphenyl, used instead of water to obtain high-controlled temperatures, is not considered useful above about 900°. In contrast to these, it appears that the use of NS fluid will be limited only by the durability at elevated temperatures of common materials of construction.

NS fluid is a patented mixture of univalent and trivalent metallic chlorine salts, such as one mol of sodium chloride and one mol of anhydrous aluminum chloride, which solidifies to a homogeneous mass at 302°, but remains soft down to considerably lower temperatures. It is reported to be as fluid above its melting point as is water, of exceptional heat capacity, non-corrosive to iron or other ordinary metals, to withstand decomposition when in a closed system, and to be available at low cost. Its expansion is limited; it can easily be melted and resolidified in glass tubes without breaking them.

With such a material as this it would apparently no longer be necessary to resort to direct firing for operations of very high temperature. Instead the heat would be transferred by more efficient means from the hot flue gases to the NS fluid, and thence to the variously located equipment which is to be heated. Whereas direct firing results in variable and irregular distribution of heat, a liquid medium such as NS fluid permits precise maintenance of a desired elevated temperature, such as is otherwise in practice available only by the relatively expensive use of electricity for heating. If reports of NS fluid are substantiated, it should furthermore provide a concentrated means of heat transfer in such cases as low-temperature carbonization of coal, where lack of heat-transfer surface has been a limiting factor. Its concentration of heat, much greater than that afforded by flue gases, should also permit the use of much smaller oven units and other heat equipment, allowing lower temperatures in applications such as petroleum refining. Again, its exceptional heat-storing properties indicate its application in heat accumulators or regenerators for waste heat utilization.

Although NS fluid appears, after all, to be no more than an important advance in the field of saline heat-transfer media, these potential applications are significant. Still others, such as the use of materials like NS fluid for new types of domestic heating, offer interesting possibilities.

—*Industrial Bulletin of Arthur D. Little, Inc.*

Design and Installation of Instrument Boards

Part 1

By JOHN A. MASEK

GAUGES or instruments are required for efficient operation of the mechanical equipment of buildings of any size. While each instrument may be placed at the individual apparatus, the present trend is to group them together on a board or panel laid out to suit the requirements.

Materials for Boards or Panels

The oldest material was wood boards, inlaid with considerable artistic scroll work, as illustrated in Figs. 1 and 2. Although not now so popular as formerly, wood panels are still specified where cost must be kept at a minimum. *Plywood* is a very suitable material for mounting gauges and other instruments. Five-ply fir panels ¾ in. thick weigh about 2 lb. per sq. ft. and have the strength of regular wood twice as thick, can be easily drilled, made up and finished in any color. The fact that plywood can often be purchased locally and made right on the job is an advantage. Such panel boards cost around $1 per sq. ft., or even less. It is argued that it is better to use the instrument appropriation toward the purchase of instruments rather than to put too much into the board.

Marble was also used years ago to a considerable extent when appearance was of importance. In recent years it has lost much of its popularity for instrument panels.

Slate has come into considerable use and there are now many grades to select from. Ribbon and Clear Black are the least expensive — about 25% less than the electrical grades. They serve very well for the average-size job but cannot be used where electrical instruments come in contact with the panels, as the metallic veins prevent their use in this case.

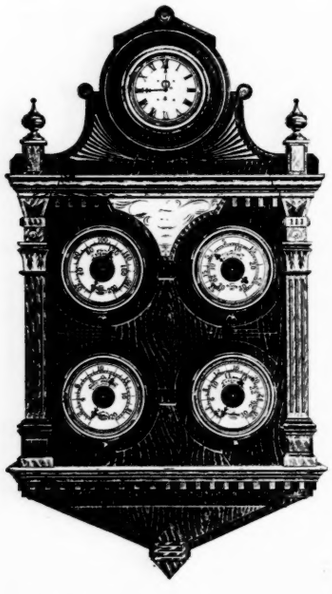
Where electrical contacts and instruments are mounted on a slate panel "electrical" slate should be used. Some of the grades are known as Monson, Blue Vermont and Imperial Black (see Fig. 6). The average thickness of various panel sizes to be considered in designing can be classified as follows:

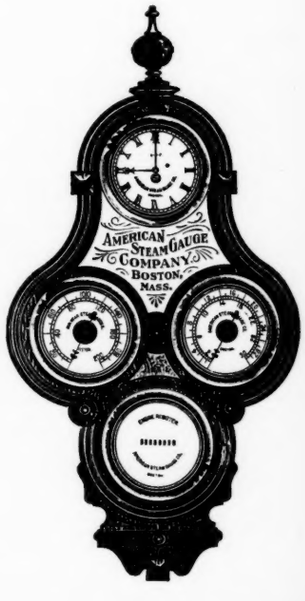
Size of Panel, Ft.	Usual Thickness, In.	Bevelled Edges, In.
2 × 3	1	¼
3 × 4	1¼	¼
4 × 5	1½	⅜
5 × 6 and over	2	½

Asbestos ebony resembles slate very much and has come into wide use under its various trade names. It is an asbestos fiber with a binding of cement densely impregnated under heat and pressure. Due to its strength and ability to absorb knocks without harm, it will not crack easily. It will withstand vibration and heat and is immune to moisture and most chemical reactions. The dialectric strength is greater than any of the materials so far mentioned. It is particularly adaptable for use where electrical instruments are to be mounted.

Since it is about one third stronger than slate it is much lighter. The ease with which large holes can be cut and drilled makes it an ideal material for panels where flush-type instruments are to be mounted. A comparison of the approximate weights for 1 sq. ft. for various thicknesses is shown on the following page.

Stock asbestos ebony sheets are made 36 in. × 48 in., 42 in. × 48 in., and 42 in. × 96 in. These sizes should be kept in mind when designing instrument panels so the required sizes can be cut from the standard sheets. In practice it has been found that panels around 42 in × 48 in. can be furnished ¾ in. in thickness. Sizes greater than this should be 1 in. or a fraction of 1 in. more in thickness for use with surface - mounted instruments (see Fig. 5). For flush - mounting instruments where large holes have to be cut, the thickness should be increased by ¼ in. at least (see Fig. 7).





Figs. 1 and 2. Scrollwork was popular on the gauge frames used years ago. These models were available in black walnut, cherry, mahogany, or oak.

Steel panels for mounting instruments are now being used to an important extent. Cold-rolled sheets of ⅛-in. thickness of the grade ordinarily used in making steel furniture are in vogue. Stainless steel has been used for instrument panels where appearance is a consideration.

Fig. 3. A gauge board in a Chicago building. Instruments added later were installed to the right and left of the original board.

Steel panels are light in weight, easy to erect, and possess great strength. They can be so shaped and built that they do not require any auxiliary supporting framework. In square or rectangular shapes they can easily be fabricated. The usual practice is to have the edges turned back 2 in. or 3 in. and then a final bend of 1 in., giving the edges a U-shape, which adds to their stiffness and to the finished appearance. The right-angle sides thus formed are utilized for bolting adjacent panels together and this construction also permits fastening supporting bolts and brackets at the rear of the panel without obstructing the front surface with bolt heads.

Thickness of Panels, In.	Weight of 1 sq. ft. of Slate or Marble, Lb.	Weight of 1 sq. ft. Asbestos Ebony, Lb.
½	8	5
¾	13	8
1	16	10
1¼	20	13
1½	25	15
2	30	18

Some switchboard manufacturers now use steel panels exclusively and make them available in many sizes, one of the largest being 90 in × 36 in. These panels can easily be adapted for instrument boards.

Instrument panels can be made in any sizes from stock sheets up to 66 in × 120 in. A sheet of steel ⅛ in. thick weighs 5.1 lb. per sq. ft.; 3/16 in. weighs 7.5 lb. per sq. ft., while ¼ in. weighs 10 lb. Boiler room instrument panels are now usually made of steel. The usual design is to bend the sides at right angles to the front of the panel in a U-shape. A top plate is added as a roof. The rear may be exposed or a door added.

For fairly large panels, 3/16 in. is used extensively. It is seldom that a thickness of ¼ in. is required, as ⅛ in. or 3/16 in. is standard for most panels.

The price of panel material is from $2 to $5 per sq. ft. (or even more) with drilling and finish important factors as well as kind of material and size.

Since it is now customary to mount instruments on panels some instrument manufacturers are mounting the internal parts of their various instruments on a steel panel. A protection case is fastened over the parts in the back of the case while a hinged glass cover is fastened in front. The dial or revolving chart is on the surface of the panel thus making each an integral part of the instrument board. Adjacent instrument panels can easily be built by bolting panels together.

Designing Instrument Panels

Gauges and instruments should be so placed on an instrument board that the major instrument will be in the line of vision if possible. They should be mounted symetrically and pleasing to the eye. This is particularly true when there are instruments of different manufacture, shape and size (see Figs. 8 and 9). Indicating instruments should preferably be placed above recorders. Controllers can be placed at the bottom of the panel.

Several rough pencil sketches will usually give the best layout, from which the size can be determined. Before the actual designing of the panel can be attempted the case dimensions and drilling templates should be secured from the manufacturer of each instrument either from his catalogs or by direct request. Manufacturers can furnish either a blueprint or a full-size template drawing, made on a sheet of

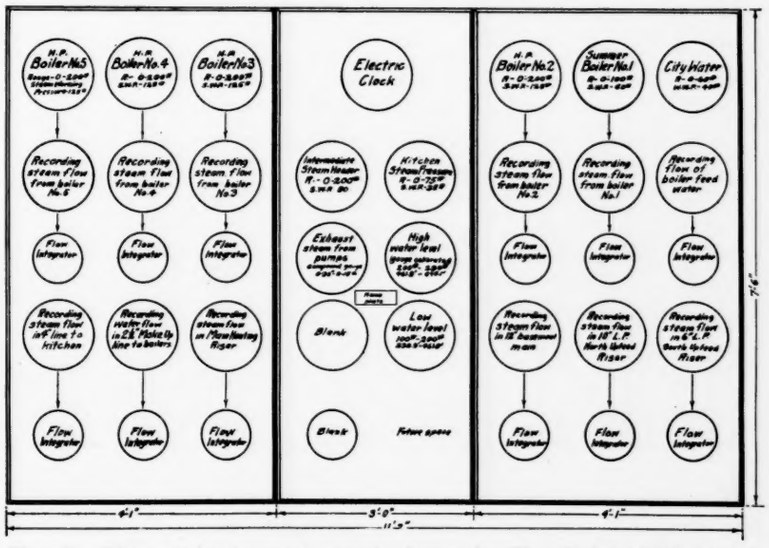


Fig. 4. Plan of instrument panel shown in Fig. 6, installed in the Chicago Board of Trade Building.

Fig. 5. Side view of a gauge board with surface-mounted gauges.

wrapping paper by placing the instrument on it and drawing around it.

Where there is a temperature control system on the job it is desirable to include the hand control pneumatic or electric remote control switches on the same panel (see Fig. 9). The least average space required for such switches is about 6 sq. in.

Samples of switch boxes and bull's-eye signal lights should also be secured when designing a panel layout.

Spacing between the instruments is a matter of choice to some extent but depends also on the number of instruments to be mounted in a given space. One or 2 in. between is sufficient but is too close to be really desirable in most cases. Where space will permit the spacing below has been used for the average round-case instruments.

While this space will be more than ample it has the advantage of allowing sufficient space between recorders to permit opening doors to change charts.

An instrument board with many instruments should be designed using several smaller panels rather than one large one. The same layout with smaller panels will usually be less expensive than one large massive panel. When large slate panels weighing hundreds of pounds are handled there is a possibility of breakage and they take longer to install. As a comparison, if one large instrument board is made from one slab of slate or other material which will require a thicker piece, and another is designed with several smaller and thinner panels, a saving of at least $1 or more can be made for each square foot involved.

In practice it is seldom that one finds a gauge or instrument board that does not require some alteration after the plant is put in operation and additional space for possible future instruments should be provided on most large boards.

Size of Dial, In.	Approximate Outside Diameter of Flange and Rim, In.	Spacing between Cases and Edges of the Panel, In.
5	7	3
6	8	3
8	10	4
10	12	5
12	15	6

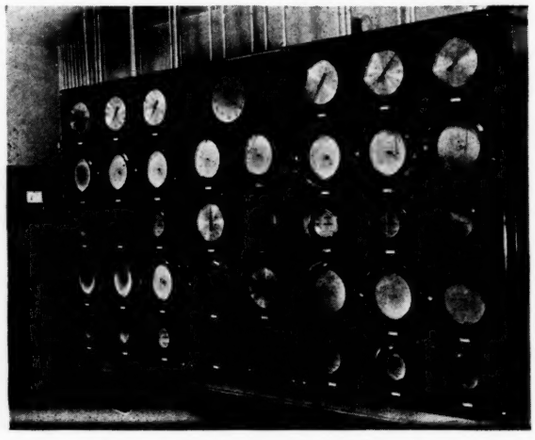


Fig. 6. Large instrument board made of slate. Pipes lead from the top to the source of pressure. Plan shown in Fig. 4.

Sometimes the operator is compelled to mount added gauges on the nearby wall or to fasten pieces of boards on existing boards to take care of extra instruments (see Fig. 3). A board made up of smaller panels lends itself to changes due to modifications of plans. Smaller panels with bevelled edges break the monotony of a plain surface and give it a modern appearance.

A small-size instrument board can be considered, one about 3 ft. × 4 ft. or smaller on which several gauges, instruments, or controls may be mounted. They are usually installed several feet off the floor so that the dials can be seen easily and the controls manipulated. The mounting of the panels is accomplished by fastening to the wall or column.

Where there are more instruments to be accommodated than in the above space a larger panel can be used. However, it is more practical to add a base panel equivalent to the top size, and adds to the attractiveness of the job. One or two rows of instruments such as recorders or integrators may be placed on the lower panel. Where conditions will permit on any fair-sized installation it is desirable to follow the design method used on vertical electric switchboards. This avoids makeshift layouts.

Where a great number of instruments and control devices are used the bench board or control desk is used. It consists of instrument panels having a horizontal or slightly inclined section for mounting pneumatic or electric control switches and signal lamps. It has vertical upper panels in the back section of the bench part. The vertical sections accommodate the indicating and recording instruments.

The control desk has many

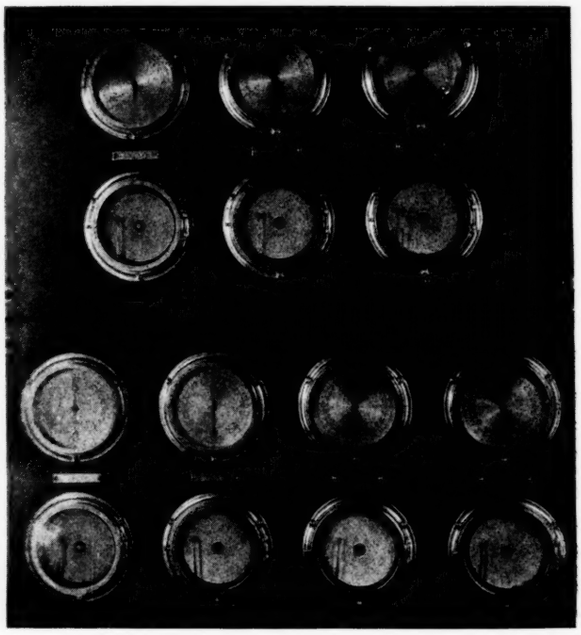


Fig. 7. Indicating and recording gauges for a heating plant, mounted on two asbestos ebony panels.

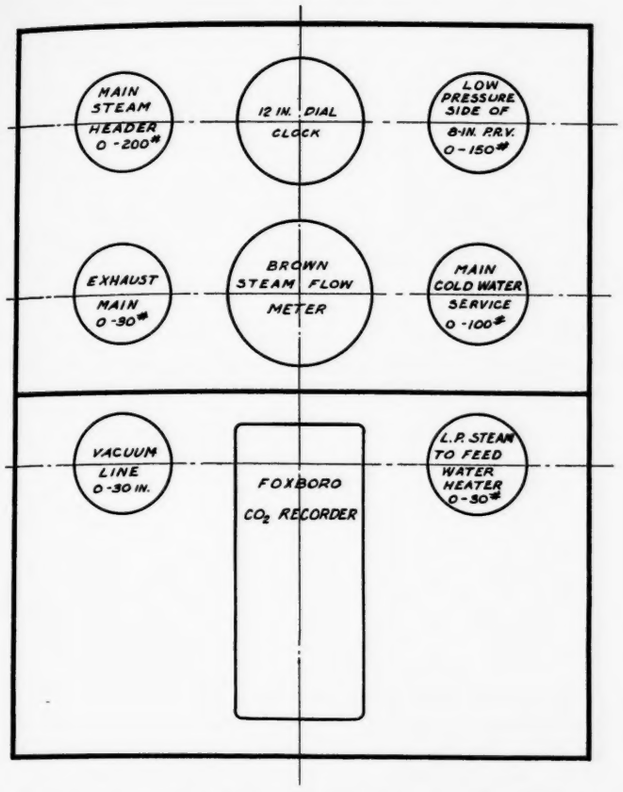

MAIN STEAM HEADER 0-200#
12 IN. DIAL CLOCK
LOW PRESSURE SIDE OF 8-IN. P.R.V. 0-150#
EXHAUST MAIN 0-30#
BROWN STEAM FLOW METER
MAIN COLD WATER SERVICE 0-100#
VACUUM LINE 0-30 IN.
FOXBORO CO_2 RECORDER
L.P. STEAM TO FEED WATER HEATER 0-30#

Fig. 8. A symmetrical arrangement of instruments on an instrument board in a veterans' hospital in Kentucky.

advantages where a very compact arrangement is desired to control the section of the heating and air conditioning system from one accessible place. The bench part can also serve as a desk convenient for log recording.

Cost of Instruments

There are many opinions as to what constitutes adequate instrument equipment. Cost, individual conditions, and engineers' preference as to the type are important factors that go to determine what instruments will be mounted on an instrument panel. Since the approximate cost of instruments is often desirable before instrument board equipment is worked out the following is given as a rough guide for preliminary estimating.

Selection of gauges is often a perplexing problem on account of the difference in dial sizes, kind of case, and the range in prices. The dial size of gauges selected for gauge boards will vary from 5 in. to 12 in. depending upon circumstances. The price variation between the various surface-mounted indicating gauges is as follows:

Gauge	With Black Iron Case	With Plated Brass Case
Standard type	Less than $1 to $2 per dial inch	From $1 to $3 per dial inch
Special grade	From $1 to $3 per dial inch	From $3 to $5 per dial inch

Sizes ordinarily ordered for mounting on gauge boards are 8, 8½, 10, and 12 in. in dial size. Either of the first two sizes are most generally used. The extra charge for flush-mounting cases for these instruments will average from $8 to $12 in addition to the above costs.

The average prices for mercury or vapor tension distance recording thermometers are from $60 to $85 for a one point temperature reading. An indicating dial distance thermometer will cost from $25 to $60 depending upon size and length of capillary tubing. If two or four temperatures are recorded on one chart the price of the thermometer will average around $40 to $50 per point. A single temperature electric resistance indicating pyrometer can be secured as low as $35.

Electric resistance recording thermometers are coming into use, and while expensive if used for one temperature, yet if the same instrument is made to accommodate eight temperatures the price will average around $70 to $80 per point (see Figs. 12, 18 and 19). If 16 or more points are recorded on the same strip chart the price will be from $40 to $50 per temperature.

When remote indicating temperature readings are desired for an arrangement of, say, around 16 different points the price per temperature will average around $25 per point (see Figs. 12 and 20). Some recent electric thermometers for indoor and outdoor air temperatures put on the market have brought the average price for a total of eight temperatures to an average of $10 per point. If 16 temperatures were used with the same instrument the price will average about $8 per temperature.

A boiler flue draft gauge costs from $10 to $30 for each draft reading. CO_2 meters range from $250 to $500 each, depending upon type and kind. A recording and integrating flow meter costs from $250 to $300. If a separate remote indicating flow dial is used in conjunction with electrically-operated flow meters add about $75.

In the past, all recorders were furnished with spring-type clocks for revolving the charts at a definite speed. These have to be wound by hand every time the chart is changed . With the perfection of electric clocks the trend is to furnish all recording instruments with an

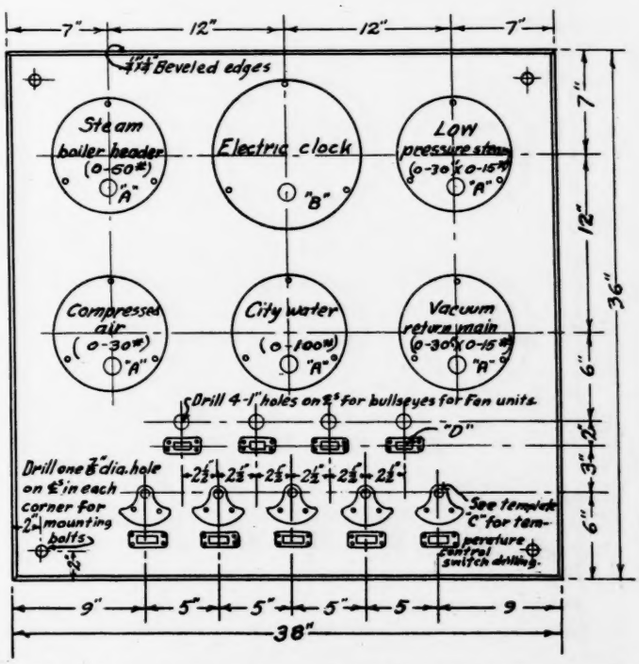


Fig. 9. Layout for a small instrument and control panel for a school building.

Instrument Boards Permit Reduced Operating

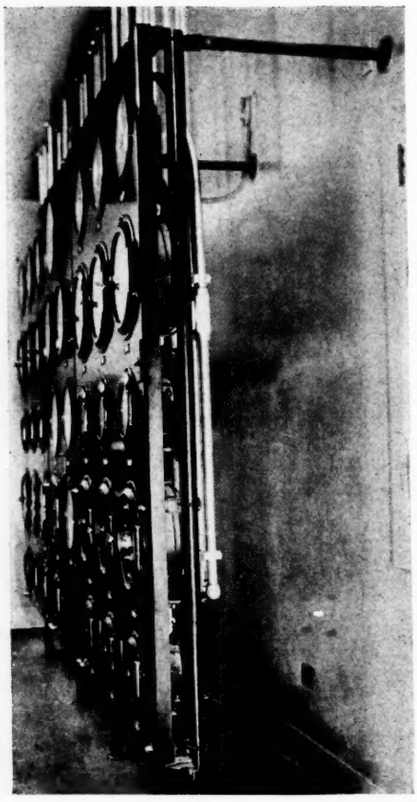


Fig. 10. Instrument board with flush-mounted cases. The ample space back of the board permits ready inspection and repair.

Fig. 12 (Right). The center instrument is an electric resistance indicating thermometer giving temperature readings at any of a number of points, depending on the setting of the lower knob. On either side are 16-point recording thermometers

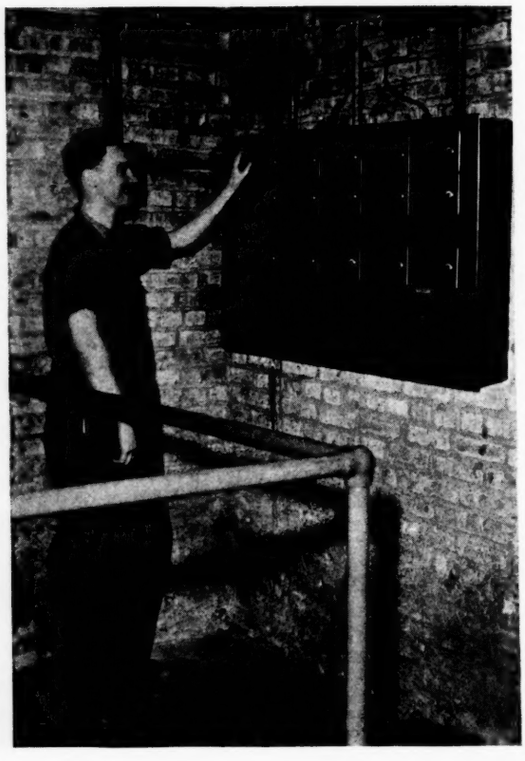


Fig. 11 (Left). Operating a central control switch.

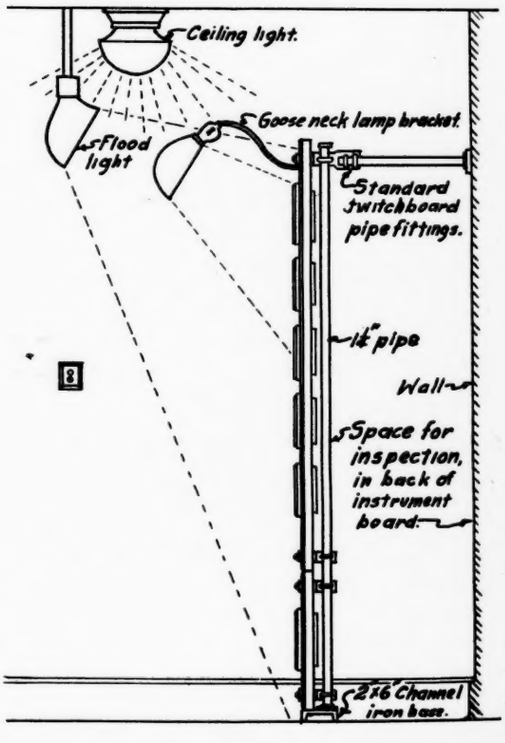


Fig. 13 (Right). Three methods of illuminating an instrument panel. The author recommends the floodlight.

Remote Control and Costs

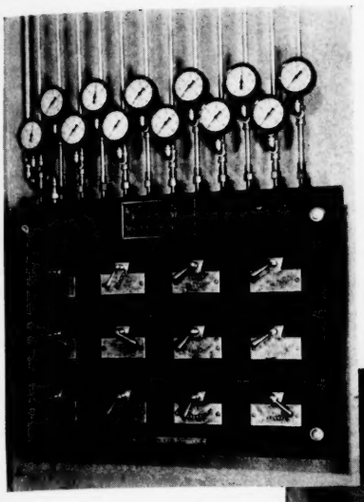


Fig. 14 (Left). Main steam valve pneumatic controls. See Fig. 17

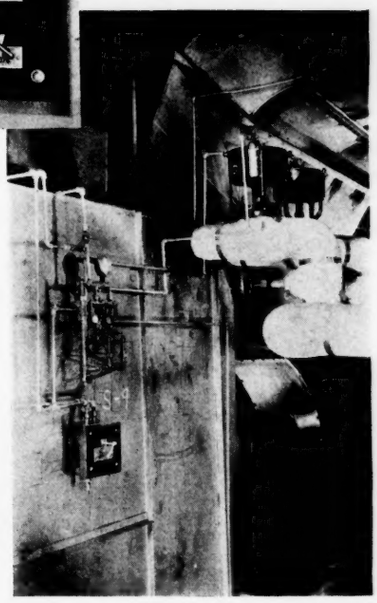


Fig. 15 (Right). Pneumatically-operated steam control for a ventilating system. The duct thermostat shown at the top of the board can be located any distance from the fan unit.

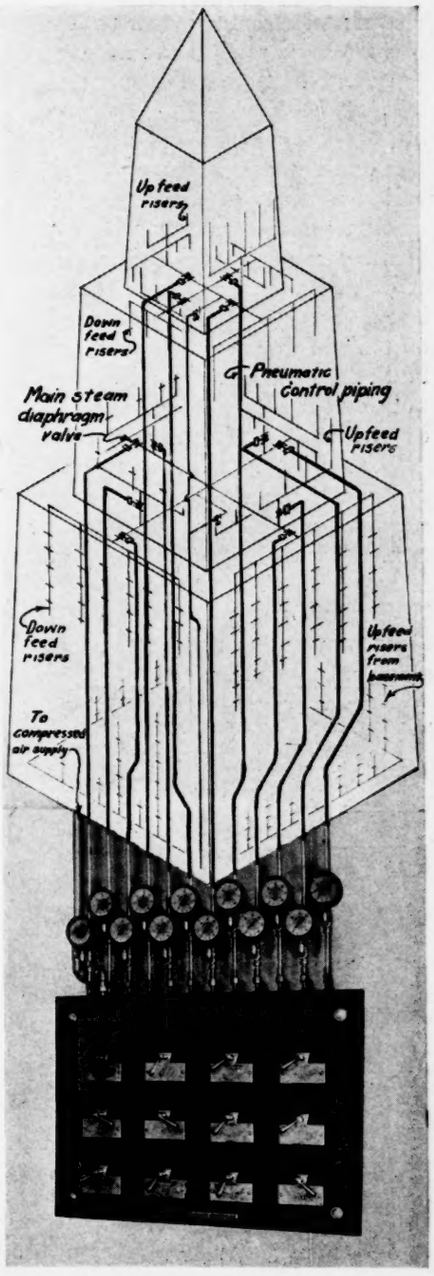


Fig. 17 (Above). Schematic arrangement showing how the board illustrated in Fig. 14 is connected to the steam valves throughout the building.

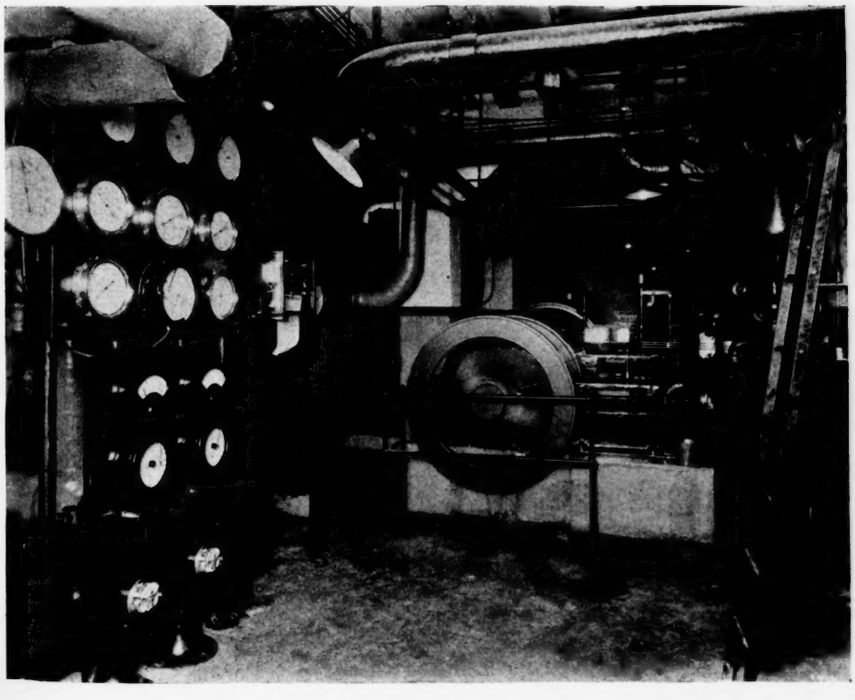


Fig. 16 (Left). An instrument board illuminated by a floodlight reflector from above.

electric telechron movement. An additional charge of about $5 will remove the trouble of winding the recording clock daily.

Service Markings

All important instruments on a piece of apparatus and particularly instruments on boards should be labelled with their respective service markings for identification. This is of value to the different operators and avoids misunderstanding when new help is hired. Service markings can be imprinted or engraved on the dials of indicating instruments. It is important that the markings desired should be mentioned at the time of ordering the gauges or instruments. In some cases this will be done without charge.

With recording gauges the markings can be engraved or stamped on the rim of the glass cover. The usual practice is to fasten small brass service plates about 1 in. × 5 in. underneath and adjacent to each instrument. The plates are usually finished to match the finish of the cases, the letters being filled in with black or white paint to make them stand out. These service plates cost around $1 each.

Some very fine service plates are made from black bakelite with the letters deeply cut out on an engraving machine. The letters when filled in with silver or gold bronze, are more attractive than stamped letters.

Card holders are sometimes fastened on panels. The inspection of many instrument boards will show that the service cards are crudely lettered by the operator, and this detracts from a fine instrument board layout.

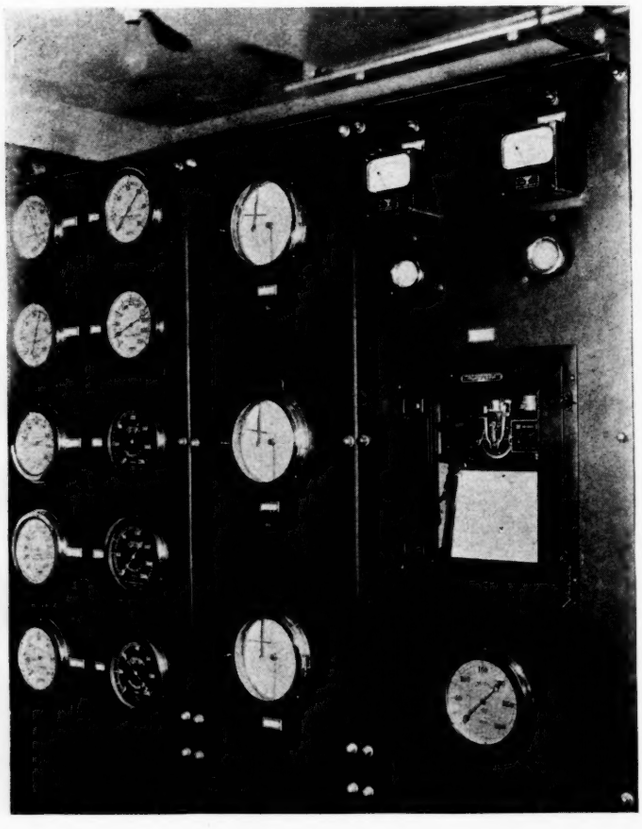
Boards and panels should be placed where they are accessible and where the operator or engineer will find it easy to use them in order to see that there is a continuity of efficient service. Sometimes the mistake is made of mounting all instruments on one board where two or three panels conveniently located would be more practicable.

Panels should not be exposed to moisture or condensation and should be free from corroding fumes and abrasive dust. The instrument board should have ample space between it and the wall so the piping can be inspected, the lines drained occasionally, and the gauges, thermometers, and other instruments be tested or removed for repairs if necessary (see Fig. 10). Panels mounted on the wall should have the piping and gauge cocks so arranged that the gauges and other instruments can be taken off without going through too much trouble.

Illumination of Instrument Panels

The illumination of gauge and instrument boards has not been given the attention it deserves. Costly instruments are sometimes installed only later to be overlooked because the operator must get too close to the dial and strain the eyes due to poor light. Often the only source of illumination is the regular ceiling light intended only to light the room (see Fig. 13).

Goose neck light brackets are often fastened at the top of the panel. Show case light troughs are used but the difficulty of either method is that the upper rows of instruments will get most of the light. The lower



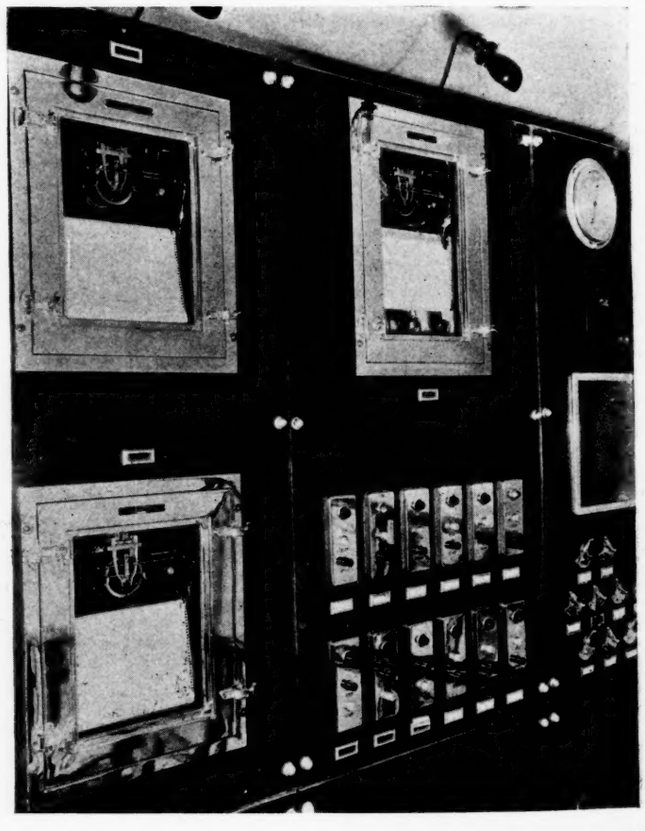
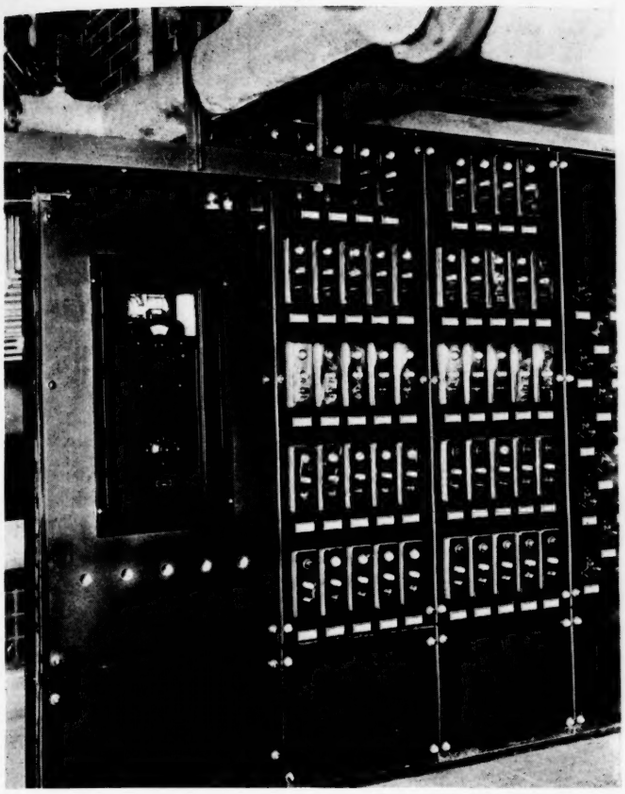


Fig. 18 (Left). An instrument board in a theater with a temperature recorder shown in the square mounted instrument. Other instruments include indicating and recording pressure gauges and distance indicating dial thermometer, the last having black dials. Fig. 19 (Right). Three temperature recorders on a heating and ventilating panel board of an office building. The switches control the operation of fans at remote locations.



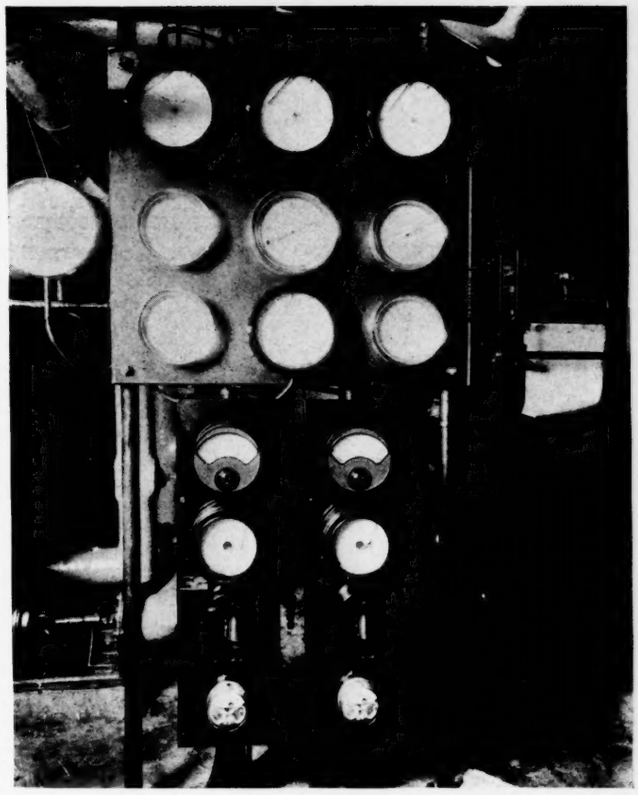


Fig. 20 (Left). Pneumatic control switches are shown at the right of this panel, while the center two panels have electric switches mounted with bulls'-eyes. At the left is indicating electric resistance thermometer. Fig. 21 (Right). An instrument board on which are surface-mounted electric resistance thermometer, pressure indicating and recording gauges, distance recording thermometers, and flow meters.

rows of instruments will have a shadow cast from the top of the case rim. Shadows cast by the indicating hand or pointer are apt to cause confusion in readings.

The best method of illuminating an instrument board is from a good diffused enamelled flood light reflector. The direct light should be several feet in front and slightly above the level of the top of the panel. The direction of the reflector should be set to avoid reflections from the glass dials or glare from the polished case surfaces (see Fig. 16).

(*To be continued*)

British Board Investigates House-Heating

EXPERIMENTS to test the economy of continuous heating as compared with intermittent heating have recently been completed in the experimental house of the British Building Research Station at Watford, Hertfordshire.

Throughout one winter the four rooms of the house were automatically maintained at a suitable constant temperature day and night by electrical convection heating. During the following winter, the rooms were heated from 5:30 a.m. until 5:30 p.m., reaching the temperature maintained in the tests of the previous year at 9:30 a.m. After correction had been made for variations in outside temperature, it was found that the intermittent heating had required only 75% as much power as was required for continuous heating.

The results of a series of experiments on insulating materials show that, for excluding sun heat, treatment of the under surface of a thin roof is almost as important as treatment of the upper surface. It was brought out clearly that a most effective material for this purpose consists of a metal sheet having a highly reflective white upper surface and a bright non-radiating lower surface. Galvanized sheeting, white-washed on its upper surface, and with its metallic lower surface kept clean and bright, is recommended as the simplest practical application. Metal-faced plywood is suggested for the lower surface of a double roof, and aluminum-faced wall paper has been found useful for improving an existing non-metallic or dirty roof.—

A. C. Blackall.

Federal Building Appropriations Now Total Nearly $300 Million

Some now in construction stages—bulk to be under way in 1934. Plans now going forward. Contemplated and total projects have increased sharply since January

APPROXIMATELY 83% of the $3.3 billion Federal Public Works appropriation had been allocated up to and including November 21, according to announcements by Administrator Harold L. Ickes. The allotments were within a period of 19 weeks after Secretary Ickes assumed the role of administrator.

According to an analysis made by HEATING AND VENTILATING of the projects for which money has been appropriated and allocated, the amount so far apportioned to buildings totals $297,537,185, or 9% of the allotted total, the remainder being devoted to all other types of construction such as dams, sewers, highways, and similar projects. The building total is made up of three principal groups as follows:

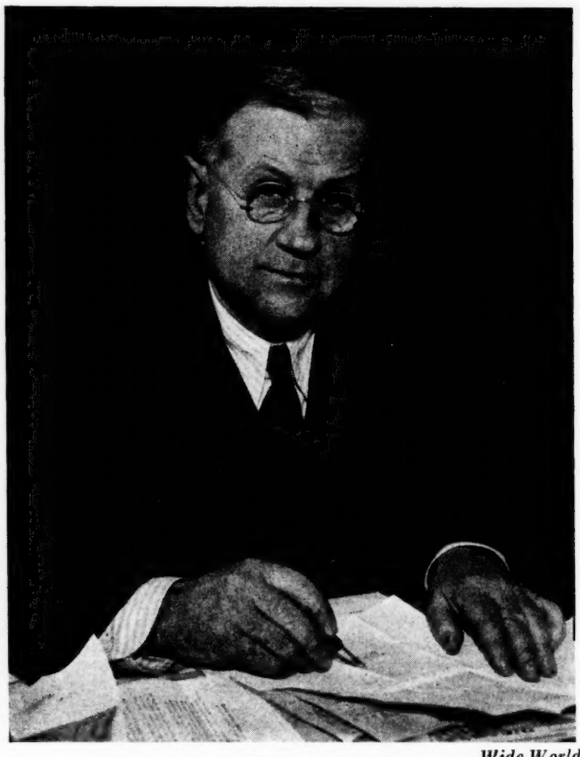
Loans and grants to towns and cities for schools, hospitals, and similar buildings....	$28,369,586
Loans to limited dividend housing corporations for large apartments.....	48,247,958
Allotment to the Federal Emergency Housing Corporation for building large apartments and slum clearance projects.....	100,000,000
Allotments to other Government departments (War, Treasury, Navy, etc.) for various buildings needed for their various uses.....	120,919,641
Total	$297,537,185

It is significant that the bulk of the money which so far had been allotted for building will go for large-scale projects and large buildings. The $148 million which will be used for building large apartments, both by limited dividend private corporations and by the Federal Emergency Housing Corporation, will be entirely for large construction. Much of the allotments made to the Treasury and War Departments for buildings will also be used for large buildings.

How Much Has Reached the Contract Stage?

Construction contracts (all types of construction) for public-financed work are reported as follows:

July	$20 million
August	47 million
September	73 million
October	101 million



Wide World

Secretary of the Interior and Public Works Administrator Harold L. Ickes

Increasing momentum of the Federal Public Works Program brought about a larger volume of construction contracts during October than in any month since May, 1932. The October total of contracts for all kinds of construction in the 37 states east of the Rocky Mountains amounted to $145 million, compared with $123 million in September, and $107 million in October, 1932. October was the first month this year which had a contract total larger than the corresponding month of last year. In the territory covered by the F. W. Dodge Corporation contracts for work to be financed out of public funds have been increasing at the practically uniform rate of $27 million a month ever since July.

October was also marked by substantial increases in the volume of contemplated new construction reported. The amount of such work reported in the new plan stage was $887 million, which topped by $40 million the big volume of new plans reported in the preceding month. The enormous increase in new construction plans is strikingly seen by comparing the October total of $887 million with the $102 million total of last January. Most of the increase in contemplated work has been due to anticipation of loans and grants of Federal funds. These increases have included a wide variety of project classifications: educational buildings, hospitals and institutions, public buildings, social and recreational projects, housing projects, public engineering works, and public utilities. There have also been increases in the volume of new plans for commercial and factory building projects, but these are largely outside the direct influence of the public works program.

The definite gain during October in construction contracts, as shown by the Dodge figures, was noted by PWA officials as being tangible evidence that a substantial portion of the Public Works allotments is now reaching the final stage.

It is expected that the

broad scope of the PWA program will become more apparent in the contract records of the coming months, especially in 1934.

Private Apartments and Housing Projects

Appropriations to limited dividend corporations for low-cost housing in large cities and their suburbs total $48,247,958. These include four in New York, two each in Philadelphia, Cleveland, and Atlanta, and one each in Boston, Hutchinson (Kan.), Indianapolis, St. Louis, Raleigh, San Francisco, Cincinnati, Richmond, and Chicago, as follows:

Neptune Gardens, Inc., Boston	$3,500,000
Spence Estate Housing Corp., Brooklyn	2,025,000
American Federation of Full-Fashioned Hosiery Workers, Philadelphia	845,000
Dick-Meyer Corp., New York	3,210,000
Suburban Housing Association, Hutchinson, Kan.	40,000
Indianapolis Housing Project, Indianapolis	4,460,000
Neighborhood Association, St. Louis	500,000
Euclid Housing Corp., Euclid, Ohio	1,000,000
Limited Dividend Corp., Cleveland	12,000,000
Hillside Housing Project, Bronx, N. Y.	5,184,458
Hallet Cove Garden Homes Project, Astoria, Long Island	2,975,000
Hillcreek Homes Corp., Philadelphia	1,290,000
Boylan Housing Project, Raleigh	200,000
Roosevelt Terrace Housing Development, San Francisco	3,230,000
Techwood, Inc., Atlanta	2,600,000
University Housing Corp., Atlanta	1,212,500
Cincinnati Housing Project, Cincinnati	1,980,000
Sunshine Apartment Corp., Richmond	663,000
Harms Park Housing Corp., Chicago	1,333,000

Federal Emergency Housing Corporation

The $100 million allotment to this governmental agency was made November 21, at the same time that Administrator Ickes announced that the first slum clearance project to be undertaken by the Corporation would be in Detroit. Between $3 million and $4 million will be spent on the Detroit project to provide housing at $6.30 per month per room.

About 20 other cities, including Cleveland, Chicago, and New York, have requested that the Housing Corporation build apartments. Simultaneously, Secretary of Labor Perkins asked other cities to submit plans for slum clearance projects.

The Detroit project, if approved, will be erected and operated by the Federal Government, but if the Michigan Legislature grants the city's request to create a municipal housing authority, Detroit will take over the project. The construction will consist of two-story fireproof row houses. The project will employ approximately 2000 men, working 30 hr. a week for six months.

Governmental Department Appropriations

The bulk of the money allotted to the Departments will go for construction other than building. The important building items to be undertaken include:

Freedmen's Hospital	$85,000
Howard University	2,278,811
Repairs to White House	6,000
St. Elizabeth's Hospital	930,000
Department of Justice—Construction	851,000
Department of Labor—Immigration	1,393,480
Post Office Improvements	7,600
Treasury Department—Public Buildings	55,877,135
Quartermaster Corps—Army Housing	57,240,615
Naval Hospital, Philadelphia	2,250,000
Total	$120,919,641

The Treasury allocation includes the cost of 86 postal sub-stations in large cities. Twenty-seven stations in New York will cost $6,843,400, while 13 others in Brooklyn will total $1,517,000 more. Chicago will have 18 stations costing $2,456,000. Those for other cities are: Boston, four stations, $419,000; Cleveland, nine, $884,000; Philadelphia, 12, $1,803,000; Pittsburgh, three, $286,000.

The stations will be of a plain commercial type so designed as to be easily convertible for commercial purposes if desired. They will serve the government in place of leased stations on which leases have expired or will shortly expire.

Loans and Grants to Cities and Towns

A list, by states, of PWA allotments to non-federal agencies follows. These range from a $34,500 grant to Auburn, Me., for a school, to one of $3,700 to Watsonville, Calif., for a library.

ALLOTMENTS FOR BUILDING CONSTRUCTION TO NON-FEDERAL AGENCIES†

(*Up to November* 12, 1933)

California	$1,101,300
Colorado	1,317,111
Connecticut	705,700
Delaware	26,000
Florida	75,000
Georgia	2,340,730
Idaho	42,600
Illinois	2,812,105
Indiana	15,000
Iowa	479,800
Kansas	215,100
Kentucky	165,195
Maine	34,500
Maryland	969,000
Massachusetts	5,066,020
Minnesota	116,100
Missouri	1,599,857
Montana	828,000
Nebraska	12,200
New Hampshire	193,000
New Jersey	1,608,405
New Mexico	24,500
New York	2,493,900
North Carolina	21,500
North Dakota	24,000
Ohio	57,000
Oklahoma	363,000
Pennsylvania	982,000
Rhode Island	965,000
South Carolina	227,700
South Dakota	7,500
Tennessee	893,433
Texas	3,000
Utah	511,200
Vermont	1,400
Virginia	677,200
Washington	390,600
Wisconsin	1,306,630

†*Does not include loans to limited dividend corporations for housing or money spent by federal government departments in these states. Most of the loans and grants listed above are to cities, towns, and villages.*

Heat Content, or Enthalpy of Mixtures of Air and Water Vapor, with Charts

By C. O. MACKEY† and CARL SHABTAC‡

MANY calculations in air conditioning are applications of the laws of the conservation of mass and the conservation of energy. In applying the conservation of energy principle, no property of a fluid is more important than the *total heat, heat content,* or *enthalpy*. All three of these terms are used to designate the same property, but in the discussion that follows, the authors will use the term *heat content*. Strangely enough, there is no property of a fluid that has been more abused by heating and ventilating engineers. Lately, however, many engineers have shown an interest in the true heat content of mixtures of air and water vapor, and there is also some demand for the properties of such mixtures at temperatures below 0°. The authors have prepared charts from which the true heat contents of mixtures of air and water vapor may be found for dry-bulb temperatures from —40° to 500° and for relative humidities from 0% to 100% over some of this temperature range.

By a definition that is now accepted throughout the entire field of engineering thermodynamics, the *heat content* of any substance in any state is the sum of the internal energy of the substance plus the pressure-volume product in that state. Before a numerical value is assigned to the heat content of a substance in a definite state, an arbitrary datum is chosen at which either the internal energy or the heat content is taken as zero. For example, in Keenan's Steam Tables, the heat content of water at a temperature of 32° and a pressure of 0.0887 lb. per sq. in. abs., i.e. saturated water, is taken as zero (which is equivalent to assuming a small negative value of internal energy equal to the pressure-volume product); in ammonia tables, the state of the saturated liquid at —40° is the datum.

In using the conservation of energy principle to find the quantity of heat transferred to or from a fluid flowing through any apparatus in which no energy is stored, the procedure is to equate the content of the fluid entering the apparatus plus the quantity of heat supplied (or minus the quantity of heat removed) to the heat content of the fluid leaving the apparatus, provided there is a negligible change in velocity and elevation of the fluid in passing through the apparatus, which is the case in the heating and cooling of air.

The particular fluid of interest in air conditioning is a mixture of dry air and water vapor. The heat content of such a mixture is the sum of the heat content of the dry air and the heat content of the water vapor, and is dependent upon the state of the mixture as fixed by the dry-bulb temperature, wet-bulb temperature (or relative humidity), and barometric pressure. In equation form,

$$h = h_a + Wh_s \qquad (1)$$

where

h = heat content of the mixture, in B.t.u. per pound of dry air,
h_a = heat content of the dry air, in B.t.u. per pound.
W = specific humidity, or the weight of water vapor mixed with each pound of dry air, in pound, and
h_s = heat content of the steam in the mixture, in B.t.u. per pound.

Before proceeding further the question of the arbitrary choice of a datum state must be settled. The authors suggest using the usual datum for the steam (so that steam tables and charts can be used directly, if necessary) and using —40° as the datum temperature for the dry air, thereby avoiding negative values of heat content in the usual calculations. In short, dry air at —40° is arbitrarily said to have zero heat content. The use of two different datum temperatures in the same equation will not prove confusing in numerical calculations, because no matter how startling the performance of the air conditioning apparatus, it will not change dry air into water vapor, or vice versa. Note that in applying the conservation of energy principle to processes involving mixtures of dry air and water vapor, the heat content of any steam, water, or ice supplied to or leaving the apparatus must then be referred to 32° as the datum temperature.

From Equation (1), there are three quantities that must be found before the heat content of a mixture of dry air and steam can be calculated; viz., (1) heat content of the dry air, (2) weight of water vapor mixed with each pound of dry air, and (3) heat content of this water vapor. Considering each of these quantities in turn the heat content of

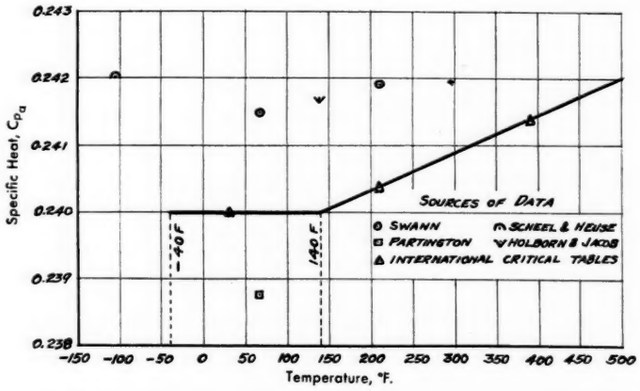


Fig. 1. Specific heat of dry air at constant pressure

†Assistant Professor of Heat Power Engineering, Cornell University.

‡Formerly a graduate student at Cornell, now with General Electric Company.

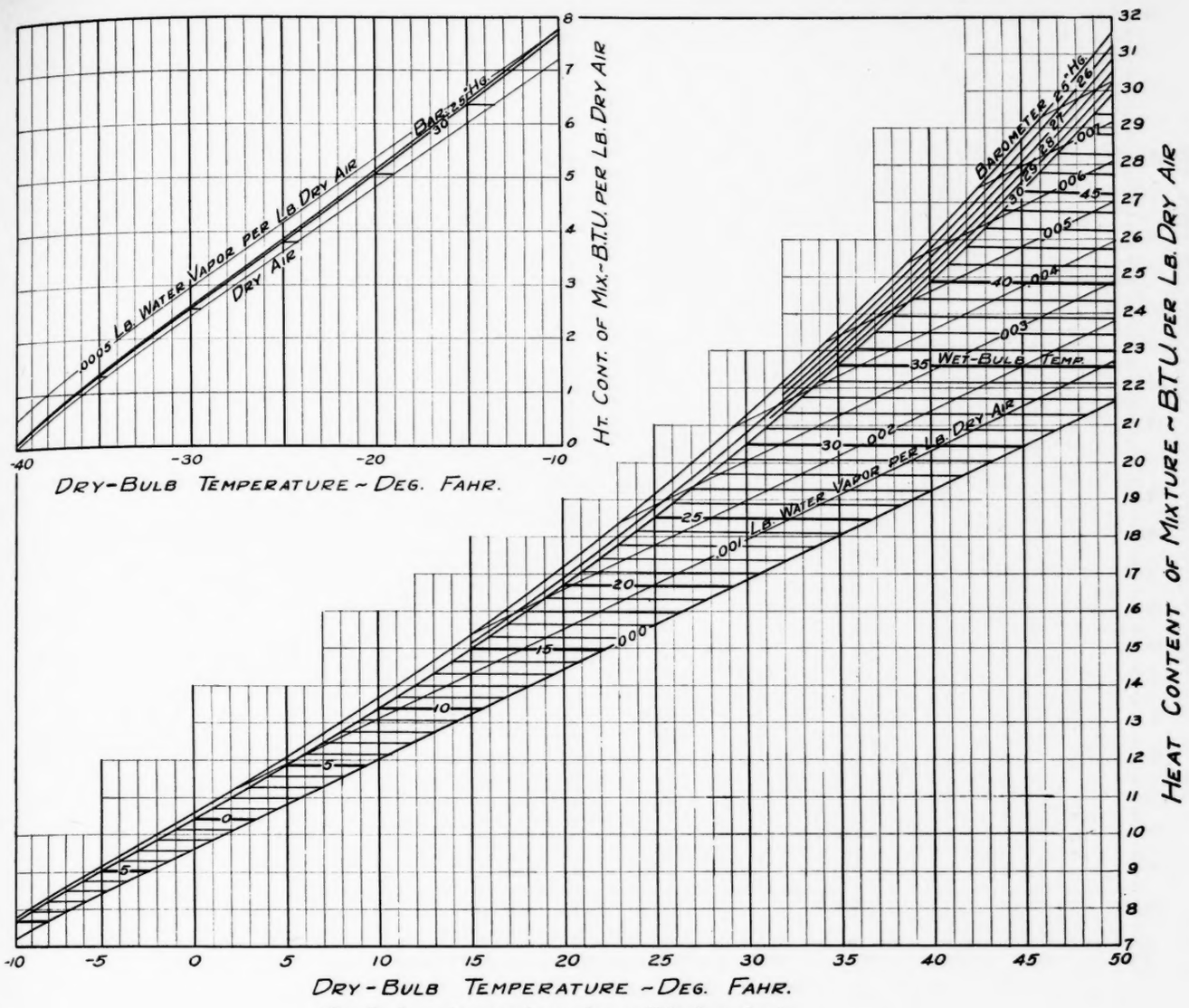


Fig. 2. Low temperature air conditioning chart

the dry air above —40°, for any dry-bulb temperature t, is

$$h_a = \int_{-40}^{t} C_{p_a} dt \qquad (2)$$

The calculation of this heat content depends upon a knowledge of the value of the specific heat at constant pressure for dry air, C_{p_a}. Neglecting the extremely small effects of changes in pressure, the specific heat at constant pressure of dry air is known to change with temperature, and the values of C_{p_a} that have been found by several investigators, together with the values from the International Critical Tables, are shown plotted against temperature in Fig. 1. In the temperature range from —40° to 140°, the values of C_{p_a} lie between 0.238 and 0.243. The derivative $\frac{d\ C_{p_a}}{d\ t_p}$ is very small in this temperature range, and although positive at 140°, it may be negative at —40°. Since the experimental evidence is insufficient to fix the value of C_{p_a} to closer than 0.002 in this temperature range, a constant value of 0.240 has been used by the authors. Obviously, use of a variable specific heat carried to four or five decimal places implies an accuracy of knowledge that is not justified in this temperature range.

For the temperature range from 140° to 500°, the derivative $\frac{d\ C_{p_a}}{d\ t_p}$ is between 1 to 10 $\times$ 10^{-6} per °F., and the authors use the value, given in the International Critical Tables, of 5.55 $\times$ 10^{-6}.

Then from Equation (2) in the temperature range from —40° to 140°, the heat content of dry air is

$$h_a = \int_{-40}^{t} 0.240\ dt = 0.240(t + 40) \qquad (3)$$

In the temperature range from 140° to 500°, the heat of the dry air is

$$h_a = 0.240(140 + 40) + \int_{140}^{t} [0.240 + 0.00000555(t - 140)]\ dt$$
$$= 9.654 + 0.23922\ t + 0.00000278\ t^2 \qquad (4)$$

Note that the numerical value of h_a depends only upon the dry-bulb temperature t.

Specific humidity, or the weight of water vapor mixed with each pound of dry air in a mixture of the two fluids depends upon dry-bulb temperature, wet-bulb temperature, and the total pressure of the mixture. The method of calculating this quantity, familiar to most heating and ventilating engineers, will not be described in detail here.

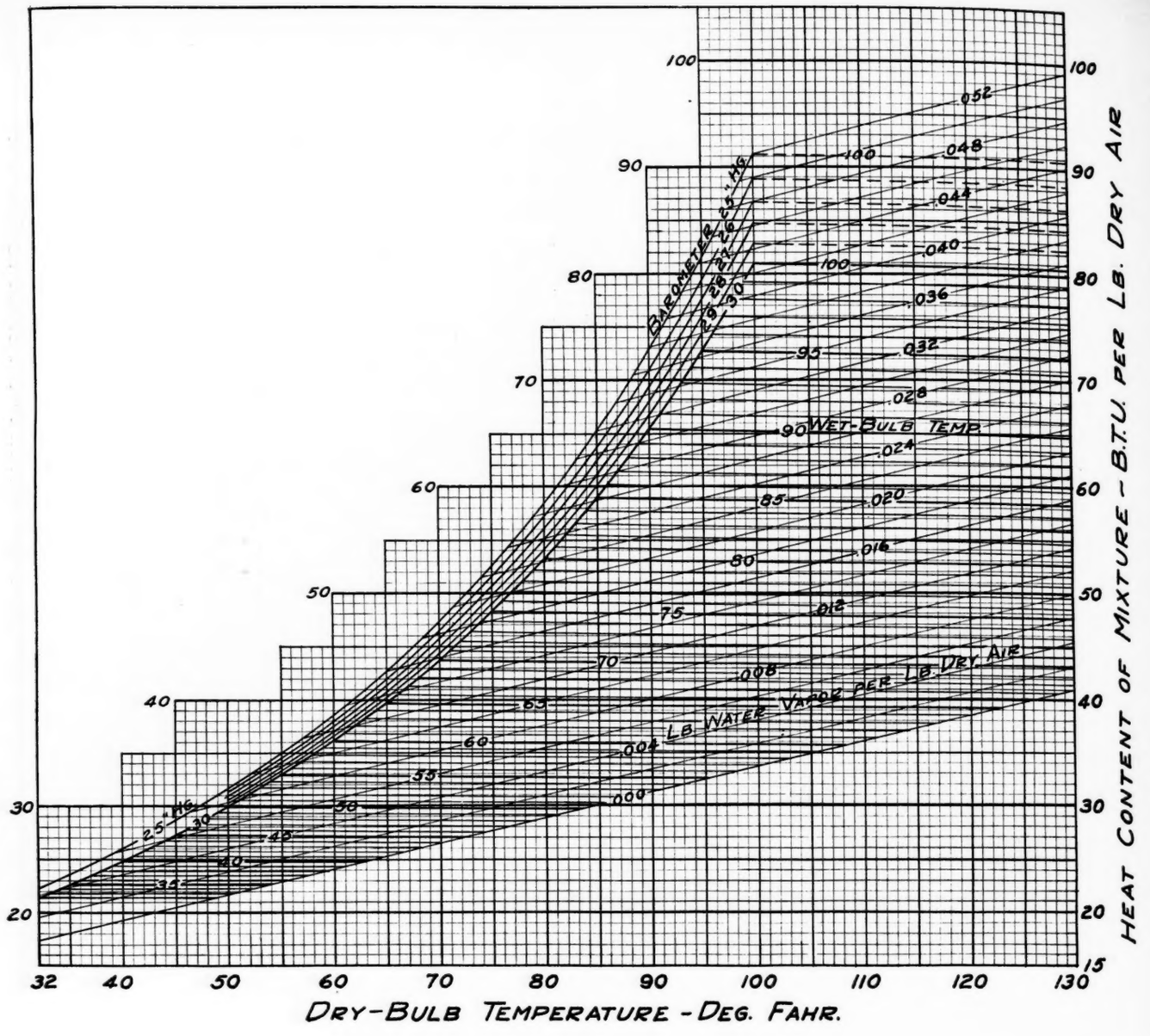

DRY-BULB TEMPERATURE - DEG. FAHR.
HEAT CONTENT OF MIXTURE - B.T.U. PER LB. DRY AIR
LB. WATER VAPOR PER LB. DRY AIR
WET-BULB TEMP.
BAROMETRY
32 40 50 60 70 80 90 100 110 120 130
15 20 30 40 50 60 70 80 90 100

Fig. 3. Medium temperature air conditioning chart

Heat content of steam may be read directly from steam tables, such as those of Joseph H. Keenan, for temperatures above 32°. Steam mixed with dry air is under low partial pressures in most instances and, in such cases, the heat content of the steam, whether saturated or superheated, depends only on its temperature. For example, from Keenan's Tables, the heat content of saturated steam at a temperature of 130° is 1117.2 B.t.u. per lb., while the heat content of superheated steam at the same temperature is 1117.9 if the pressure of the steam is 1 lb. per sq. in. abs., or 1117.4 if the pressure is 2 lb. per sq. in. abs. The following equation gives the heat content of either saturated or superheated steam, at partial pressures under 5 lb. per sq. in. abs. for temperatures up to 500°, with an error of less than 1/4 of 1% when compared with the tables:

$$h_s = 1059.2 + 0.45\ t \qquad (5)$$

This equation may be extrapolated to obtain the heat content of steam at temperatures below 32°, and the results are consistent with the best experimental evidence available.

The accompanying psychrometric charts (Figs. 2, 3, and 4) give the weight of water vapor mixed with each pound of dry air and heat content of the mixture of dry air and water vapor for various combinations of the dry-bulb temperature, wet-bulb temperature, and total barometric pressure. The low temperature chart[1], shown in Fig. 2, covers a range of dry- and wet-bulb temperatures from —40° to 50°. The medium temperature chart[2], shown in Fig. 3, includes dry-bulb temueratures from 32° to 130° and wet-bulb temperatures from 32° to 100°. The high temperature chart, shown in Fig. 4, includes dry-bulb temperatures from 100° to 500° and wet-bulb temperatures from 80° to 181°. All

[1]In the low temperature field, the lines of constant wet bulb temperature were plotted in accordance with the U. S. Weather Bureau Bulletin No. 235.

[2]In placing the lines of constant wet-bulb temperature in the medium and high temperature fields, the general method used by W. H. Carrier and explained in his paper presented to the A.S.M.E. in 1911 was followed, although the values of specific heat and heat content used in these charts are slightly different.

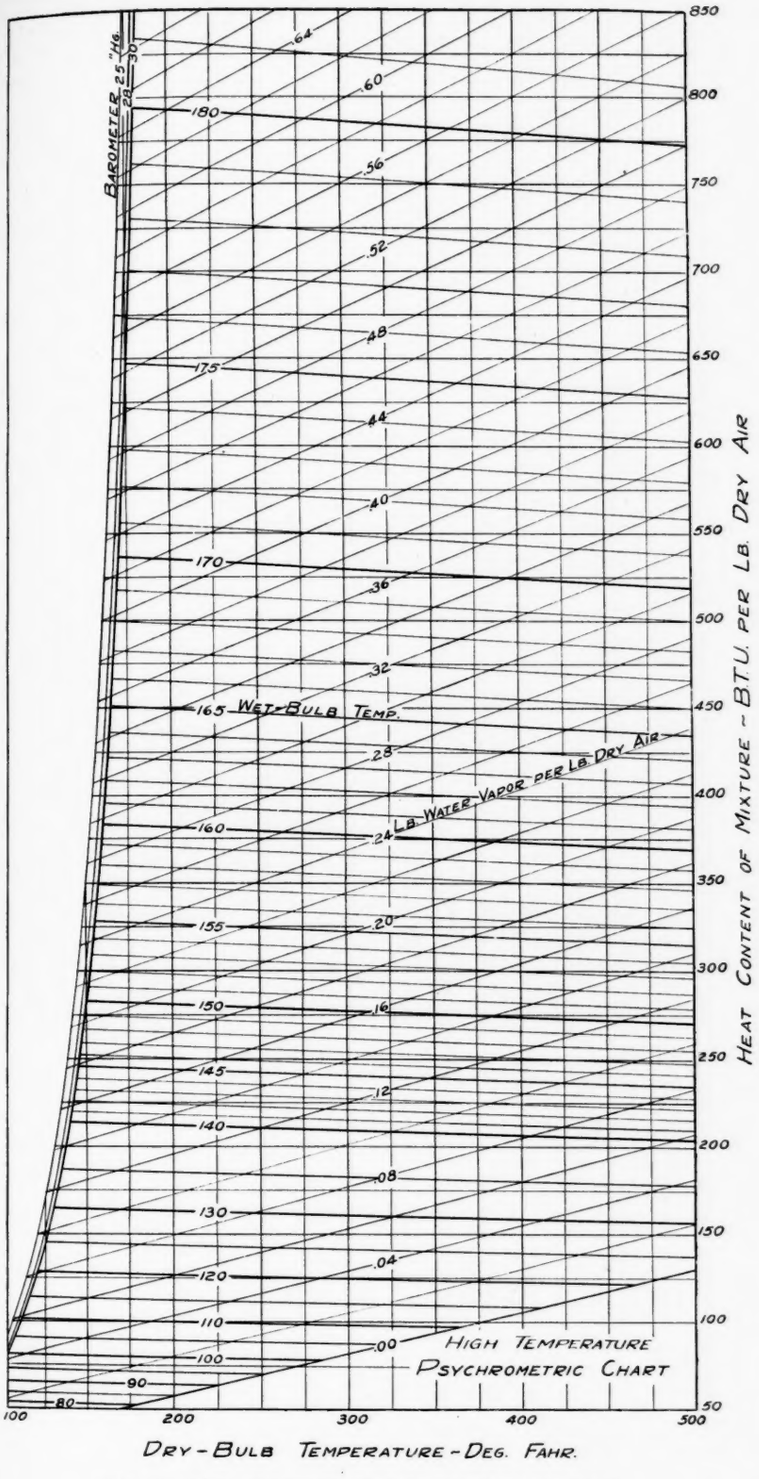


Fig. 4. High temperature air conditioning chart

the charts cover total pressures from 25 in. to 30 in. mercury abs.

In using these charts, note that the lines of constant relative humidity of 100% are drawn for several barometric pressures, but the lines of constant wet-bulb temperature are drawn for only one barometric pressure, 30 in. mercury abs. Most engineering calculations will not warrant consideration of the normal deviations from this latter pressure, but their effect may be found from the chart if desired. To use the charts, a point is spotted on the chart corresponding to the observed dry-bulb temperature, wet-bulb temperature, and barometric pressure; the weight of water vapor mixed with each pound of dry air is then found by interpolating between the lines of constant weight, and the heat content of the mixture is read on the ordinate scale.

For example, in Fig. 3, for a dry-bulb temperature of 80°, a wet-bulb of 70°, and a barometric pressure of 30 in. mercury, the state point is spotted at the intersection of the proper dry-bulb and wet-bulb temperature lines.

Interpolating between the lines of constant weight, the pound of water vapor per pound of dry air is 0.0133; on the ordinate scale, the heat content of the mixture is 43.7 B.t.u. per lb. of dry air. The dewpoint is found by following a line of constant weight to the left to the curve for 100% relative humidity and reading the temperature at this intersection on the dry-bulb scale; in the example above, the dewpoint will be found to be 65.5°. Although only two lines of constant relative humidity are shown (0% and 100%) the relative humidity may be *estimated* by interpolating between these lines; in the example, the relative humidity would be estimated as about 60%. Additional lines of constant relative humidity might be drawn, but their addition would add greatly to the complexity of the charts. Since a knowledge of the dry-bulb and wet-bulb temperatures is the usual starting point, and since the relative humidity is a derived value and not a direct reading, the authors decided to omit these additional lines. If the relative humidity be required, it is usually in connection with the question of human comfort, and the authors suggest the use of the familiar charts, on which wet-bulb temperature is plotted vs. dry-bulb temperature and lines of constant relative humidity and constant effective temperature are drawn, as auxiliary charts in connection with the accompanying charts.

For barometric pressures less than 30 in. mercury, the lines of constant wet-bulb temperature are raised, as illustrated by the lines of constant wet-bulb temperature of 100° that are drawn at the top of the chart for barometric pressure of 25, 26, 27, 28, 29, and 30 in. mercury. Since these lines are nearly parallel for a given wet-bulb temperature, their position may readily be estimated, if necessary, by following over from the proper curve of 100% relative humidity. For example, in Fig. 3, for a dry-bulb temperature of 80°, a wet-bulb of 70°, but a barometric pressure of 25 in. mercury, the intersection of a temperature of 70° and the 100% relative humidity line for a pressure of 25 in. mercury is spotted, then following to the right along an imaginary line parallel to the lines of constant wet-bulb tem-

perature until 80° is reached, the weight of water vapor mixed with each pound of dry air is found to be 0.0165 lb. and the heat content of the mixture is read as 46.9 B.t.u. per lb. of dry air. Note the effect of barometric pressure on these two properties; in this case, for the same dry-bulb and wet-bulb temperatures, with a barometric pressure of 25 in. mercury the specific humidity is increased about 24% above the value for a barometric pressure of 30 in. mercury, and the heat content of the mixture is about 7.3% higher with the lower barometric pressure.

A property of a mixture of air and water vapor that has been called "total heat" since the original definition by Carrier in 1911 is defined by the following equation:

$$\Sigma = Cp_a (t - 0) + W [h'_{fg} + Cp_s (t - t')] \qquad (6)$$

where

Σ = "total heat" of the mixture, in B.t.u. per pound of dry air.
Cp_a = mean specific heat at constant pressure of dry air.
Cp_s = mean specific heat at constant pressure of the water vapor.
h'_{fg} = latent heat of vaporization at the wet-bulb temperature.
W = specific humidity, or pound of water vapor per pound of dry air.
t = dry-bulb temperature, °F.
t' = wet-bulb temperature, °F.

With this definition, the true heat content of the dry air above a datum temperature of 0° is added to a quantity which is less than the true heat content of the water vapor in the mixture by an amount equal to the product of the specific humidity and the heat content of the liquid at the wet-bulb temperature. The convenience in defining the "total heat" of a mixture of air and water vapor in this way is because this property of the mixture is constant at constant wet-bulb temperature, whereas the true heat content, total heat, or enthalpy of the mixture decreases slightly with an increase of dry-bulb temperature at constant wet-bulb temperature as the charts show. One inconvenience in calling such a property of the mixture "total heat" is that the meaning of this term does not then agree with its meaning in all other branches of engineering thermodynamics. A second inconvenience in using this term, as previously defined, is that negative "total heats" are encountered for temperatures below zero. A slight error is involved in using this "total heat" in place of the true heat content of the mixture in applications of the conservation of energy principle. This numerical error is usually negligible, and the authors have no quarrel on this score with those who wish to continue to use the older term, particularly since the use of the term suggested by Carrier has greatly simplified the solution of many problems for men who were not very familiar with the basic thermodynamics. On the other hand, if the charts and tables of the heat content of mixtures of air and water vapor are to be extended to lower temperatures, as several engineers have suggested, that extension should be thermodynamically correct and consistent with the best practice in other fields of engineering.

It is hoped that the accompanying charts meet such requirements without adding to the difficulty of securing rapidly the specific humidity, the heat content, and the dewpoint of mixtures of air and water vapor when the dry-bulb temperature, the wet-bulb temperature, and (if necessary) the barometric pressure are known.

Puzzled Readers Enlightened on Initials

NEW government agencies have sprung into being with such rapidity and in such variety, and in many cases designated by such long and cumbersome names, that most of them go by their initials. In many instances the meanings of these initials have evaded the reading public, and it is to allay this confusion that the following key is printed:

NRA—National Recovery Administration.
NIRA—National Industry Recovery Act, parent of the preceding.
RFC (Inherited)—Reconstruction Finance Corporation.
ICC (Inherited)—Interstate Commerce Commission.
PWA—Public Works Administration.
CWA—Civil Works Administration.
FEC—Federal Emergency Housing Corporation.
FHLB—Federal Home Loan Board.
FHOLC—Federal Home Owners Loan Corporation.
SAB—Science Advisory Board.
NLB—National Labor Board, presided over by Senator Wagner, New York.
PEC—President's Executive Council.
PAB—Petroleum Administrative Board.
TVA—Tennessee Valley Authority.
CSB—Central Statistical Bureau, officially interpreting all government figures.
FCT—Former Commissioner Eastman in his role as Federal Coordinator of Transportation.
FDIC—Federal Deposit Insurance Corporation.
AAA—Agricultural Adjustment Administration.
CCC—Citizens' Conservation Corps.
CCC (Junior)—Commodity Credits Corporation, making loans on cotton, etc.

Heat Transfer Rates in Heating Boilers and Furnaces†

By F. C. HOUGHTEN

HEAT transfer rates per unit area of surface in heating boilers vary widely depending upon the type and make of boiler, the fuel used, the percentage of capacity at which the boiler is operating, and the location of the surface in the boiler. Heating surface in boilers using solid fuel may be divided into: heating surface in contact with the fuel bed, surface above the fuel bed but in view of it, and heating surface in the passes of the boiler through which the hot gases of combustion flow. Boilers using other fuels have similar variations in characteristics of heating surface.

Perhaps the best data available on heat transfer through a surface in contact with the fuel bed are contained in a United States Bureau of Mines publication which gives operation characteristics and rates of heat transfer for different parts of a small round boiler. Heat transfer rates ranging from 1710 B.t.u. per sq. ft. of heating surface per hour when burning bituminous coal at a rate of 1.3 lb. per sq. ft. of grate per hour, to 6580 B.t.u. per sq. ft. per hr. with a combustion rate of 4.4 lb. per sq. ft. per hr. are given. Anthracite gave heat transfer rates ranging from 2630 to 10,130 B.t.u. per sq. ft. per hr. for combustion rates ranging from 1.4 to 5.2 lb. of fuel per hour per square foot of grate. For coke, heat transfer rates ranging from 3160 to 11,450 B.t.u. per sq. ft. per hr. were found for combustion rates ranging from 1.5 to 5.6 lb. of fuel per hour. Heat transfer rates for surfaces in contact with hot gases are seldom given for unit areas of surface for any particular part of the boiler, largely because such values cannot easily be determined by experiment, and because the myriad variations in shape and location of such surfaces met with in practice, particularly in cast-iron boilers, do not lend themselves to the determination of unit rates by calculation. It is customary to express the rate of heat transfer as an average for all the heating surface in the boiler. The United States Bureau of Mines gives such average rates of heat transfer for boilers operating under different conditions and burning different kinds of solid fuel. Table 1 gives average rates of heat transfer found for two boilers burning anthracite, coke, and bituminous coal at different rates of combustion.

It should be emphasized that these heat transfer rates are averages for the entire boiler and are made up of varying rates ranging from a maximum where the hot gases leave the point of combustion at temperatures which may reach as high as 1800° to minimum rates of heat flow at points where the flue gases leave the boiler at temperatures which may be as low as 300° or 400°.

Heat transfer rates per unit area of surface in warm-air heating furnaces also vary widely, depending upon the type and make of furnace, fuel used, percentage of capacity at which the furnace is operated, and the location of the surface within the furnace. Little or no data are available giving the unit area transfer rates for various parts of the heating surface. It is the practice in the furnace industry to give combustion rates for various types of fuel in pounds per square foot of grate area and the ratio of heating surface to grate area. From these values, the calorific value of the fuel and the thermal efficiency of conversion from fuel to heat in the furnace bonnet, average rates of heat transfer for the entire heating surface area in the furnace may be computed. Very comprehensive studies of these and other relationships in warm-air heating furnace practice have been carried on by Professor Willard at the University of Illinois, and show that in good furnace practice ratios of heating surface to grate area may range from 17 to 27 and heating efficiencies may range from 48% to 70%. Accepting values of 4 lb. of 12,500 B.t.u. coal per hr. per sq. ft. of grate area as the combustion rate, 27 as the ratio of heating surface to grate area, and 68% as the heating efficiency as representing practical operating conditions for a moderately low rate of heat transfer, gives an average for all heating surfaces in the furnace of 1259 B.t.u. per sq. ft. per hr. Accepting for a moderately high average rate of heat transfer a combustion rate of 11 lb. of 12,500 B.t.u. coal per hr. per sq. ft. of grate area, a ratio of heating surface to grate area of 17, and a heating efficiency of 50%, gives an average heat transfer rate of 4044 B.t.u. per hr. per sq. ft. of heating surface. The former may be taken to represent an efficient furnace with a large area of heating surface operating at a low rate, the latter to represent a less efficient furnace with less heating surface and operating at a relatively high rate. Again it should be emphasized that these average rates of transfer are obtained by variations ranging from very much higher rates near the point of combustion to very much lower rates near the point at which the flue gases leave the furnace.

The rates of heat release in a furnace are only indirectly connected with the rates of heat transfer to the air or water. Their numerical values have little meaning unless associated with the fuel being used, the design of the furnace as related to the mixing of the gases, and the basis on which the normal rating is fixed. Consequently, the nominal heat release per cubic foot computed for different makes and sizes of boilers varies

†Abstracted from the author's paper "Heat Transfer Rates in Heating and Ventilating or Air Conditioning Practice," presented at the Symposium on Heat Transfer, annual meeting, American Society of Mechanical Engineers, New York, December, 1933.

TABLE 1
RATES OF HEAT TRANSFER, BURNING BITUMINOUS AND ANTHRACITE COAL AT DIFFERENT RATES OF COMBUSTION

Type of Boiler	Cast-Iron Vertical Sectional Boiler Manufacturers' Rating 10,900 Sq. Ft. Radiation						Cast-Iron Vertical Sectional Boiler Manufacturers' Rating 15,600 Sq. Ft. Radiation								
Type of Fuel	Bituminous			Coke			Coke			Anthracite			Bituminous		
Draft in smoke hood—In. H_2O	0.18	0.62	1.29	0.14	0.69	1.33	0.116	0.262	0.720	0.154	0.530	0.900	0.200	0.382	0.850
Per cent of mfrs. rating	47	99	139	51	96	127	50	80	113	54	89	102	56	85	117
Smoke hood temp.—°F.	512	758	832	426	673	757	347	447	554	368	537	529	557	761	654
Heat transfer rate, B.t.u. per sq. ft. per hr.; average for all heating surface	3437	7212	10114	3737	6967	9234	2310	3710	5240	2520	2685	4134	2610	3760	5436
Heat release, B.t.u. per hr. per cu. ft.	31800	68300	98900	28950	62100	83700	16500	27600	39000	18700	20400	34300	14800	33400	43400

widely. This is illustrated by the values for heat release given for the two boilers of Table 1.

The rates of heat release for five small boilers based on the manufacturers' ratings at the time the tests were made are illustrated by the following:

Manufacturers' Rating; Radiation in sq. ft.	540	575	600	650	680
Nominal Heat Release; B.t.u. per hr. per cu. ft.	36,000	39,000	22,000	60,000	32,000

Thus, a heat release of 35,000 B.t.u. would seem to be an average figure. The volume of the combustion space of warm-air furnaces is usually larger than that for boilers and the nominal heat release will be correspondingly less.

In the application of oil-firing or of stokers to standard boilers it has been customary to increase the combustion space. A committee has been appointed by the American Standards Association to standardize the settings of stokers and the combustion space necessary to produce good combustion with reasonable production of smoke.

Certified Refrigeration Saves Owner $15 to $25 per Apartment per Year

THE activity of the Chicago Master Steam Fitters' Association in the refrigeration field is of national interest to the experienced heating contractor. A few years ago when refrigeration became a part of the equipment for every modern home and apartment, members of this association were being called upon to install equipment in thousands of homes and apartments.

This presented problems familiar to the heating contractor. His experience with and the success of Certified Heating was proof of the value of engineering standards and good installation work.

Since the refrigerator is a heat-handling device it seemed that its success must depend to a considerable extent upon its operating performance in the field. Therefore, the foundation for a successful refrigeration business should be built upon practical engineering principles plus correct installation. Consequently, the Association took initial steps by directing a survey of the refrigeration field and its existing practices.

This survey revealed a large number of unsatisfactory installations and a lack of the practical engineering standards necessary for uniformity and satisfactory performance. During the past year the trend of design of heating, refrigeration and air conditioning equipment has allied all three so closely that one cannot draw a dividing line.

From the results of the field survey which included many makes of equipment in all types of building, the Association prepared certified refrigeration engineering standards and ratings for the use of its members. These standards are tabulated in a form convenient to use, yet the factors take into consideration the numerous conditions that affect operating performance, such as motor size, compressor displacement, compressor speed, kind of insulation, thickness of insulation, size and type of evaporator, use of refrigerators, exposed temperature, location of equipment, temperature of condensing medium, and other details that contribute to good performance.

The field study of operating systems also provided practical information concerning operating costs and maintenance expense. This information is valuable to the contractor and to the consumer, as both are interested to learn what types of installation will supply the best results at the lowest cost. In this respect the operating results of certified central plant systems are interesting. The refrigeration supplied is ample for the hottest weather, the hours of operation are reasonable, the operating cost is low, service is reduced to a minimum, and the operating life of the mechanical equipment is many years.

As compared with self-contained units the certified installations show a saving to the building owner of from $15 to $25 per apartment per year.

The success of those members who have engaged in the refrigeration business under the guidance of certified refrigeration engineering standards prepared by the Association convincingly demonstrates how well the heating contractor fits into the refrigeration and air conditioning field. His participation in the sale and installation is a constructive force that is certain to extend the usefulness, increase the comforts, and enhance the value of refrigeration and air conditioning to the consumer.—*D. E. Perham.*

Code Situation Quiet, Construction Code Held Up

EARLY in November there was every indication that the NRA codes would sweep ahead to rapid adoption. Codes had been filed by most groups and hearings were progressing nicely. Then without advance warning the whole machine began to slow down markedly. The result is that the past month has seen little in the way of advancement toward actual adoption. The situation regarding our codes is almost where it stood 30 days ago, with a few approved and in operation, many past the hearing stage, and the rest remaining on file.

Reasons for this state of affairs are hard to find and harder yet to rationalize. With all the urge for speed in the early stages and with the rush of formulation and filing two or three months back, the present attitude of "wait and see" is strangely at odds.

Questions of policy have vexed the NRA organization and many have come to a head within the past month. Inability to answer them satisfactorily is no doubt one of the underlying reasons for the slow-down. Enforcement machinery has had to be devised for the codes already approved. General Johnson has been impressed into duty as a speaker to sell the value of the whole program to the farmers, and his speaking has taken up a good share of the month. In the meantime many major questions have had to await his return to Washington. It is also rumored that the administration wants to consolidate its position on the existing codes before going ahead with any more. All these causes have helped to bring about the delay. How long it will continue only time will tell.

Two outstanding plans were under consideration 30 days ago, and at that time we summarized the condition in which they stood. One was the proposal that the construction groups all come under the master code of the Construction League of the U. S., while the other was to organize an Institute of Heating, Ventilating and Air Conditioning to formulate a similar master code for the manufacturing groups. The proposal regarding the construction master code was well advanced at that time but the other was in its preliminary phases.

We are able to report little or no progress on the proposal that an Institute be formed. The project is still alive, however. No announcement of progress has been forthcoming, the Institute has not been formally organized, and the tentative master code is still tentative as we go to press.

There is every evidence that within NRA there is strong backing for sending the master code of the Construction League to the President for approval. It had its scheduled public hearing some weeks ago and has since been reposing in the offices at Washington. Failure to bring it out for approval is no doubt chargeable largely to the determined opposition of organized labor. All along, labor has protested the inclusion of building construction with other types of construction under one control. Moreover, it has attacked the form of control set up. It has taken pronounced exception to the hour and wage arrangements of the master code as written. Labor representatives have appeared at most hearings on the sub-codes and have objected to the control organization and to the hour and wage provisions.

Early in the month the backers of the present master code held a meeting in Washington and took steps to try to force the issue. In public statements some of the leaders attacked the attitude of the labor federation and demanded immediate adoption of the code as written. They were willing to make minor concessions to the labor viewpoint.

The labor leaders promptly replied to these statements and appeared before Secretary Perkins with the direct charge that the Construction League was working in concert with certain administrators of NRA to nullify parts of the Recovery Act. They denied that they were obstructing progress in the building industry and restated their objections to the code. This blast provoked a counter statement from the League which unequivocally denied that it was to be held responsible for the statements, charged the labor leaders with failure to appreciate the importance of integrating the construction industry, and intimated that labor was the interest trying to disrupt the NRA.

On November 20 both interests appeared at a public hearing before General Johnson. William Green, appearing for labor, vigorously opposed the proposal of one single master code for all construction and stated that there was no more reason for such a step than that all manufacturing industry be brought under one master code. Labor favored separate codes for building construction and for general construction, and a 30-hr. week in the building construction field. R. E. Wood, a member of the NRA Industrial Advisory Board, advocated the plan of the Construction League and urged approval of its master code and sub-codes. He regarded this as a great and necessary step in permitting self-government in the construction industry.

The views presented at this hearing served to bring out clearly how far apart labor and some of the employer groups are at present on the Construction League code. Little can be done about the heating contractor codes until this major difference is adjusted and some decision is reached. No indication of how the final decision will fall is obtainable now. Powerful interests are aligned on each side and there is every reason to believe that progress will be slow with neither side willing to give in without a determined struggle.

While the code-drawing activities are pretty well completed, an occasional new code continues to appear. During the month one was filed by the engineering inspection group who examine materials at laboratories

or elsewhere to determine their suitability for construction and other purposes. Hearing on this code was scheduled for November 24. As printed, it contains no statement that this group recognizes the proposed master code of the Construction League but it would naturally fall into this class if the League code goes through as now written.

During the month, too, the indirect water heater manufacturers decided to abandon their proposed code and to operate under the code for the heat exchange group which is sponsored by the Heat Exchange Institute and which code has already been approved by the President. The administrative body has been organized and is functioning.

One of the first codes to be approved was that of the oil burner group. This code is vertical in form and its administration presents a more difficult problem than do most of the horizontal codes. The administrative Authority has, however, made marked progress in the last two months. It is probably the furthest advanced of any of the code organizations. In addition to organizing, the Authority has employed two field men to assist in plans to decentralize the administration. Regional and zone organizations have been planned and perfected. A prominent accounting firm is drawing up the cost accounting system provided in the code, and it is expected that this system will be ready for use well within the time limit. Filing of prices by manufacturers is called for in the code and this large project has gone forward rapidly. Enough have filed so that the distribution of the prices to the interested manufacturers has started. The volume of work of insuring compliance is shown by the fact that some 250 cases have already been handled through the central office of the Authority in New York.

The code approved for the steel boiler group represented by the Steel Heating Boiler Institute is administered by the executive committee of the institute. This committee is functioning and R. A. Locke has been designated as manager. Up to now the work of the Authority has consisted largely of assisting members to comply with the code provisions. This code makes no provision for determining sales prices other than that they shall be above cost. As this is a good example of this general type of code, it is being reprinted in full in this issue.

Steel Boiler Code Now in Operation

Features of the Code for Steel Heating Boilers, signed October 23, include requirements for an open pricing system whereby each member of the industry publishes price sheets for his product; all members conform to with terms, discounts and general trade practices designated by the Code Authority; no provisions are made regarding determination of sales prices other than that they shall be above cost.

Members of the Code Authority are: President, R. B. Dickson, president, Kewanee Boiler Corporation; vice-president, Homer Addams, president, Fitzgibbons Boiler Company; vice-president, J. R. Collette, vice-president, Pacific Steel Boiler Corporation; J. F. Johnston, president, Johnston Brothers, Inc.; Frank Metcalf, president, International Boiler Works; Charles M. Tull, president, Spencer Heater Company.

The Code Authority designated R. A. Locke, Middletown, Pa., as manager.

Article I—Purposes

THE following provisions are established as a Code of Fair Competition for the Steel Tubular and Firebox Boiler Industry in order to effectuate the policy of Title I of the National Industrial Recovery Act.

Article II—Definitions

The term "Steel Tubular and Firebox Boiler Industry" as used herein (hereinafter abbreviated to "this industry") is defined to mean all manufacturers of steel heating boilers as defined in Section IV, Sub-Section I, of the Boiler Code of the American Society of Mechanical Engineers; also, for all working pressures, Scotch type boilers for stationary use, vertical fire tube boilers, horizontal firebox type boilers, tubeless boilers, oil country boilers, miniature boilers.

The term "member of this industry" as used herein is defined to mean, but without limitation, all persons, partnerships, or corporations who manufacture any of the above-specified items.

The term "member of the Code" as used herein is defined to mean any member of this industry who signifies assent to this Code.

Article III—Hours

SECTION 1. (a) No employer shall employ, in any labor operations, any person more than 40 hours per week, five consecutive days and eight consecutive hours per day, exclusive a meal period, except watchmen and/or as provided under paragraph (b), provided, however, that where it is necessary to work less than 40 hours per week, the hours may be divided by agreement between the employer and the employees to a

lesser number of days per week, but in no case shall the hours exceed nine per day.

(b) In cases of emergency production, repair or erection work that cannot be met by the employment of additional men and/or it becomes necessary, in order to protect life or property, to exceed the hours scheduled in Section I (a), all such excess time shall be paid for at the rate of not less than one and one-half times the hourly rate for shop work. For all outside repair, renewal, construction and/or erection work, not less than double the hourly rate shall be paid for all such excess time.

(c) No new apprentices shall be employed in the industry except that the Executive Committee (as designated in Article VI), subject to the approval of the Administrator, may grant the employment of such new apprentices if in his judgment the existing surplus of unemployed local labor is absorbed in reasonably steady employment. This is not to be construed to prohibit instruction of mechanics already employed in this industry.

(d) For all other employees except executives, executives' secretaries, administrative and supervisory employees, and traveling and commission salespeople, the time worked shall not be in excess of 40 hours per week.

SEC. 2. No employee shall be employed or permitted to work for one or more employers in this industry in the aggregate in excess of the prescribed number of hours in a single week; provided, however, that if any employee works for more than one employer for an aggregate period in excess of such maximum without the connivance of any one of such employers, said employer shall not be held to have violated this provision.

Article IV—Wages

SECTION 1. (a) The minimum wages that shall be paid by any employer to any employee of the Steel Tubular and Firebox Boiler Industry in labor operations directly incident thereto shall be 34c per hour for the Southern territory and 40c per hour for all other portions of the United States. The Southern territory is located South of the States of Maryland, West Virginia, and Kentucky and East of the Mississippi River.

(b) Old or partially disabled employees unable to perform their usual duties are not included in the above labor provisions, except that they shall in no case be paid less than 80% of the above minimum, and provided that the total number of such employees shall not exceed 5% of the total number employed by any one employer or where less than forty (40) persons are employed such employer shall be entitled to two (2) employees of this class.

(c) The minimum wage that shall be paid by any employer to all employees, other than those covered in Section I (a) and (b) except commission salespeople, shall not be less than $15 per week; provided, however, that office boys and girls may be paid not less than 80% of such minimum wage, but the total number of such office boys or girls shall not exceed in any calendar month 5% of the total number of all employees covered by the provisions of this Section I (c) and provided further that where a State law provides a higher minimum wage, no person shall be paid a lower wage than that required by such law, within that State.

SEC. 2. No employee shall be classified in any of the exempted classes defined in this Article and in Article III, unless he performs functions substantially identical with those performed by employees thus classified on June 16, 1933.

Article V—General Labor Provisions

SECTION 1. No employer shall employ any person under sixteen years of age. Provided, that where a State law provides a higher minimum age, no person below the age specified by such State law shall be employed within that State.

SEC. 2. All employers in this industry shall comply with the provisions of Sub-Section (a), Section 7, of the National Industrial Recovery Act, as follows: (1) That employees shall have the right to organize and bargain collectively through representatives of their own choosing, and shall be free from the interference, restraint, or coercion of employers of labor, or their agents, in the designation of such representatives or in self-organization or in other concerted activities for the purpose of collective bargaining or other mutual aid or protection; (2) that no employee and no one seeking employment shall be required as a condition of employment to join any company union or to refrain from joining, organizing, or assisting a labor organization of his own choosing; and (3) that employers shall comply with the maximum hours of labor, minimum rates of pay, and other conditions of employment, approved or prescribed by the President.

SEC. 3. Any system of contracting shop work by which an employee undertakes to do a piece of work at a specific price, and engages other employees to work for him, is prohibited by this Code.

SEC. 4. The wage differentials for all operations shall be equitably readjusted and in no case shall they be decreased. No unfair advantage shall be taken of any employee in making this Code effective. Each member of this industry shall report all such readjustments to the Manager within 30 days of the effective date.

SEC. 5. No employer shall contract for the fabrication and/or erection of any of the products of this industry with any employer or employee except when such employer or employee agrees to comply with the labor provisions of this Code during the performance of the contract.

SEC. 6. Each employer shall post in each workshop and on central notice board in his factory the labor provisions of this Code.

Article VI—Administration

SECTION 1. The Steel Heating Boiler Institute, hereinafter designated as the S.H.B.I., shall not impose any inequitable restrictions on admission to membership.

SEC. 2. The Executive Committee of the S.H.B.I., to membership of which the President may appoint one

nonvoting member, is hereby designated an Agency to cooperate with the Administrator in the administration and enforcement of this Code, and for this purpose shall appoint a full-time manager who, subject to approval of the Executive Committee and the Administrator, shall (a) attempt to determine within the industry as to whether any member has, or has not, adhered to the provisions of this Code; (b) act as the industry's representative in all dealings with the Government; (c) conduct any investigation or survey within this industry that might be of general benefit to this industry.

SEC. 3. With a view to supplying data as to the observance or nonobservance of the Code, each member of this industry shall make such reports relating to matters covered by this Code at such times and in such form as the Executive Committee of the S.H.B.I., subject to the approval of the Administrator, shall prescribe. Such reports shall be received by the Manager. The Executive Committee of the S.H.B.I. may require said reports to be substantiated by oath. If the manager has reason to believe that any report of any member is inaccurate, such report may be verified by inspection of the books and records of such member by a disinterested and impartial agency designated by the Executive Committee of the S.H.B.I., subject to the approval of the Administrator. The said reports shall be held in confidence by the Manager except insofar as disclosure may be necessary for the effective enforcement of this Code.

SEC. 4. Nothing in this Code shall preclude furnishing of compiled data to the members of this industry by the Manager.

SEC. 5. In addition to information required to be submitted to the Executive Committee of the S.H.B.I. there shall be furnished to government agencies such statistical information as the Administrator may deem necessary for the purpose recited in section 3 (a) of the National Industrial Recovery Act.

SEC. 6. Members of this Code shall be entitled to participate in the Code activities of the S.H.B.I.

SEC. 7. Each member of the Code shall contribute his equitable and proportionate share toward the cost of administration of this Code, either by becoming a member of the S.H.B.I. or by paying an amount equal to that portion of the dues and/or assessments paid by members of the S.H.B.I. which are used to defray the expense of administration of this Code.

SEC. 8. Upon request of the manager each member of the Code shall submit data necessary for prorating this expense. Each member of this Code shall pay his prorated share of this expense upon demand of the Treasurer of the S.H.B.I.

SEC. 9. Each member of this industry shall report to the manager any infraction of a provision of this Code by any other member of this industry where said infraction affects the reporting member's business.

SEC. 10. Each member of this industry who violates any provisions of this Code is liable to the penalty prescribed by the National Industrial Recovery Act.

Article VII—Trade Practices

SECTION 1. In order to promote fair competition and prevent discrimination between purchasers, the following provisions shall be observed and practiced by all members of this industry:

(a) Prices, terms, and discounts shall be openly and publicly announced, and to this end they shall be issued in printed form by the individual manufacturer.

(b) All offers to sell which take the form of a quotation shall represent the true prices and terms at which the manufacturer will sell the goods covered by the quotation then being made, and any omission of parts, or the furnishing of additional equipment shall be reflected in the selling price.

(c) All goods sold shall be invoiced at the true selling prices.

(d) No member of this industry shall disseminate false or misleading information relative to competitor's products, selling prices, credit standing, ability to perform work, or labor conditions among competitor's employees.

(e) No member shall give any gratuity to any person, including, but without limitation, any natural person, partnership, association or corporation, to induce such person to specify, allow, or approve the products of a particular manufacturer.

(f) No member shall allow unjust claims for alleged shortage or breakage.

(g) No member of this industry shall circulate, not in good faith but for the purpose of harassing and intimidating customers, threats of suit for infringement of patents or trade marks among customers of a competitor.

(h) No member of this industry shall attempt to induce the breach or abandonment of any contract between a member and his customer.

(i) No member of this industry shall be a party to commercial bribery in any form or under any condition.

(j) No member of this industry shall enter into a written or oral agreement with any person that one or more clauses of the contract or the specification will not be enforced, thereby receiving an unfair advantage over competitors.

(k) No member of this industry shall make a deposit for the privilege of receiving plans and specifications and the opportunity to bid on a contract without an agreement that the return of the full amount of the deposit will be made upon the return of the said plans and specifications to the issuer.

(l) The members of this industry manufacture and sell equipment and this industry does not look with favor on guarantees of any character other than those relating to materials and workmanship, and under no condition shall any maintenance guarantees be made. No member of this industry shall promise a better performance or make a higher guarantee than previous experience indicates can be obtained.

(m) No member of this industry shall accept a contract containing a penalty clause either for performance of the apparatus sold or for time of delivery, unless the contract shall also contain a clause providing a bonus to the member at the same rate as the rate of penalty, except with the approval of the Executive Committee

whose decision shall be subject to approval of the Administrator.

(n) All quotations shall be made in accordance with published price lists and any items not covered by such price lists shall be included in the quotation with price list items and shall be itemized at the normal selling price.

(o) All members shall include in all price lists, quotations and contracts such general terms, discounts, freight terms, and guarantees as may be prescribed by the Executive Committee subject to approval of the Administrator.

(p) All members shall send to the Manager two copies of price sheets and catalogs and as many additional copies as he may require for distribution to other members.

(q) Any member making any change in a published price list shall mail notice to the manager five business days prior to effective date of such change and concurrently shall place in the mail notices to all known competitive members giving details of change. Other members by mailing notices to the manager and to all other known competitive members may make price list change effective the same date as specified in the notice received. The operation of the foregoing at all times shall be subject to the approval of the Administrator.

SEC. 2. No member of this industry shall sell any of his products at or below cost. Cost shall be determined by a system of cost accounting approved by the Executive Committee, subject to the approval of the Administrator.

Article VIII— Monopolies

No provision in this Code shall be interpreted or applied in such manner as to (a) permit monopolies or monopolistic practices, (b) permit or encourage unfair competition, (c) eliminate, discriminate against, or oppress small enterprises.

Article IX—Modification

SECTION 1. This Code and all the provisions thereof are expressly made subject to the right of the President, in accordance with the provision of Subsection (b) of Section 10 of the National Industrial Recovery Act, from time to time to cancel or modify any order, approval, license, rule, or regulation issued under Title I of said Act and specifically, but without limitation, to the right of the President to cancel or modify his approval of this Code or any conditions imposed by him upon his approval thereof.

SEC. 2. Such of the provisions of this Code as are not required to be included therein by the National Industrial Recovery Act may, with the approval of the President, be modified or eliminated as changes in circumstances or experience may indicate. It is contemplated that from time to time supplementary provisions to this Code or additional Codes will be submitted for the approval of the President to prevent unfair competition in price and other unfair and destructive competitive practices.

Article X—Effective Date

SECTION 1. This code shall be effective as the Code of Fair Competition for the Steel Tubular and Firebox Boiler Industry on the second Monday following date of approval by the President of the United States.

SEC. 2. This Code shall continue in effect for a period of ninety days after the effective date of approval and thereafter until terminated as hereinafter provided. It may be terminated at any time after the expiration of such period by the same action by members of the Code as is above provided for the amendment thereof. When so terminated all obligations and liabilities under the Code shall cease, except those for unpaid assessments theretofore made in accordance with the provisions of the Code and those for liquidation damages theretofore accrued under any provisions of the Code.

Corrosion in Exhaust Systems

DETERIORATION in ventilating and exhaust systems results principally from corrosion, the abrasive effect of the materials conveyed, or a combination of these agencies. Iron and steel that is not coated with some other metal, such as zinc or tin, is readily corrodible due to the electrolytic reactions of moisture, carbon dioxide, and oxygen normally present in air. These materials have little effect on pure zinc, except to form a thin coat of zinc carbonate on the surface through the action of carbon dioxide, which protects the zinc against further attack. Zinc is seriously attacked by sulphurous gases, however, and where present in the atmosphere these often cause rapid deterioration of galvanized pipes and ducts.

Corrosion is always accompanied by the formation of various chemical salts. These salts, commonly called rust, are of a porous structure and are capable, in the case of iron, of acting as a catalytic agent, promoting further corrosion.

Every punch, bend, cut, or drill which pierces the zinc coating on galvanized iron exposes the iron to the action of moisture, carbon dioxide, and oxygen, the agents which enter into the electrolytic corrosion reaction. It is therefore obvious that galvanized ducts and other parts of ventilating and exhaust systems, particularly at the seams and joints, should be kept dry, clean, and free of rust accumulations so far as is possible.—*John H. Vogt, New York State Labor Department, in "The Industrial Bulletin" of the State of New York Department of Labor.*

Air Conditioning the New Exhibition Hall at Cleveland

Upper level of New Exhibition Hall showing ductwork, supply outlets, and exhaust grilles. Photograph courtesy of Westinghouse

By P. H. BRYANT

A NEW Exhibition Hall, planned primarily to house the national exhibitions of industrial and trade associations, was recently completed by the City of Cleveland.

Due to certain characteristics of the building site and to the variety of purposes for which it was proposed to use its floor space, the firm of designing engineers—the Geo. S. Rider Company, Cleveland—found itself confronted with many special problems, among them that of supplying fresh air at a controlled temperature to all sections of the vast floor area.

The building is in reality an underground structure, its concrete "roof" being approximately 4 ft. below the grade of an area that has been reserved for park purposes in the municipal development known as the Cleveland Mall. Its north wall, however, is exposed, as it coincides with the face of the natural cliff that borders Lake Erie in that section of the city.

This north wall presents a finished stone facade to the outside, but is tile-walled on the inside with air space between. Except for three sliding doors at each end, it is devoid of openings, so that the requirements of heating, ventilating, and lighting are in nowise complicated and only slightly modified by the fact that one thoroughly insulated wall is exposed to the atmosphere.

The building is 461 ft. long and 390 ft. wide. It is substantially one undivided room area. The design provides two floor levels—the Upper Level, 225 ft. wide, is 10 ft. above the Lower Level, which is 165 ft. wide—both levels extending the length of the building.

For the purposes of air conditioning engineering, the building is sub-divided into four sections, separated only by the break in the floor levels and by the north-to-south centerline, as indicated in Fig. 5. Each of these four sections is provided with an air heating and outside air circulating system that is complete in every detail, and with an independent system of supply and exhaust ducts that take air to and from every portion of the section served.

There is not, in other words, a single air conditioning plant serving the building as a unit, but four plants, each a counterpart of the others except in minor details of arrangement, and each limited in its service to the particular section to which its ducts lead.

No means having been provided for interconnection between the duplicate systems in an emergency, in case of a break-down of any plant, the circulation of fresh air from the normal points of supply for the section served is cut off. Since there are no dividing walls between the sections, however, it has been assumed that

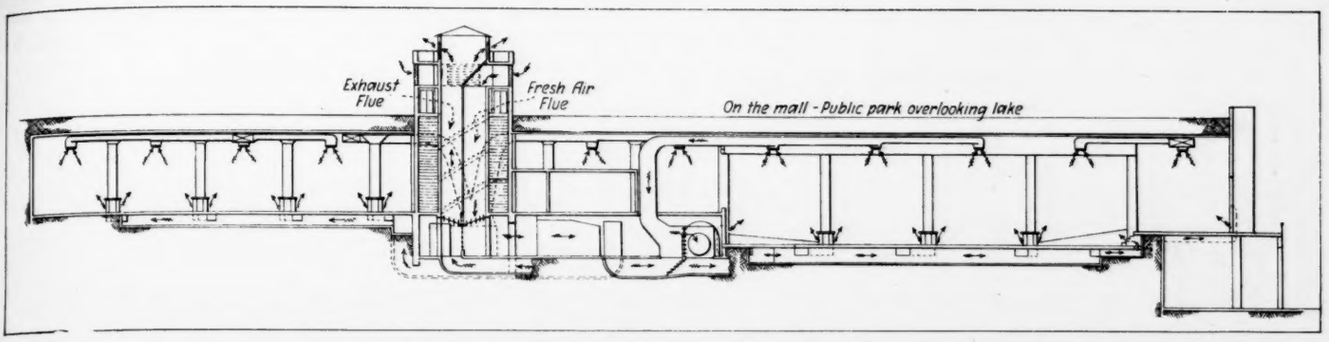


Fig. 1. Elevation, north and south section, showing underground ducts. Ceiling ducts are of similar design but of radial bends

should failures of short duration occur, the "dead" section would equalize sufficiently from adjacent sections to prevent discomfort.

Referring to Fig. 5, it will be seen that the south sections are of greater area than the north, but this difference in floor space is almost exactly equalized by the additional 8 ft. of height of the lower level. As a result, each of the four sections has a volume of approximately 1,100,000 cu. ft., or a total of 4,400,000 cu. ft. for the building.

The Fan Rooms

To air condition the building, four sets of supply and exhaust fans have been installed, each with a delivery capacity, at a maximum speed of 250 r.p.m., of 80,000 c.f.m. On the control panel of each fan motor, nine variable speeds are provided for modifying the rate of air circulation to suit varying conditions.

Fig 2. Exterior of pylon towers

The fans and the accessory mechanical equipment necessary for their operation and control, are installed in two duplicate fan rooms located midway of the east and west halves of the building, beneath the floor of the upper level, as shown in broken section in Fig. 5. In each fan room is assembled two complete circulating units as shown in outline in Fig. 5 and in added detail in Fig. 4.

Adjacent to the fan rooms, and extending upward through the building proper to a height of 20 ft. above the ground level, are pylon towers that, in addition to housing a multiplicity of exit stairways, serve as flues for both the incoming and outgoing circulated air. Below the upper level floor line these flues open out into chambers, from one of which fresh air is distributed to each of the two connected supply fans, while ports open into the other from the two companion exhaust fans.

The Circulating System

Briefly, the air circuit is as follows: Fresh air is drawn in by the supply fans through the lower set of grilles at the top of the pylons and lead downward through the fresh air flue into the supply chamber at the base of the tower. From these chambers it is split two ways to the duplicate supply circuits, passing first through an air filter, thence through a heating chamber containing steam coils to the intake of the fans. The supply fan outlets lead to a lower, forward compartment of the reversing chambers—one of the design features of the installation—where the circulated air may be directed at will either into a ramified system of subsurface conduits having a multiplicity of openings near the building floor level, or into a similar system of metal ducts leading to ceiling outlets.

The exhaust circuits lead from either ceiling or floor, depending on which is complementary to the point of supply, through two compartments of the reversing chamber to the exhaust fans, thence into the exhaust chamber of the pylon and upward through the exhaust flue to the outer atmosphere.

Special Features

The outstanding feature of this installation is in the means provided for reversing or switching the system of conduits used for supplying and exhausting the air

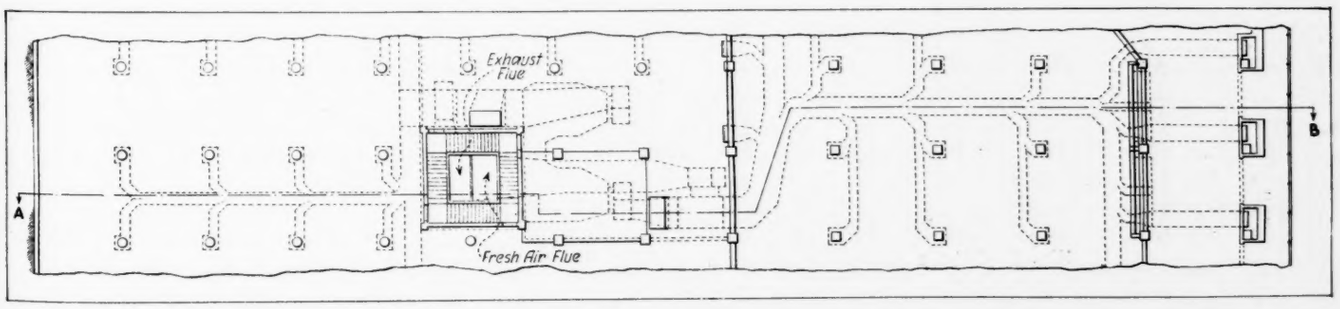


Fig. 3. Plan view, north to south section. The elevation shown in Fig. 1 is along the section A-B.

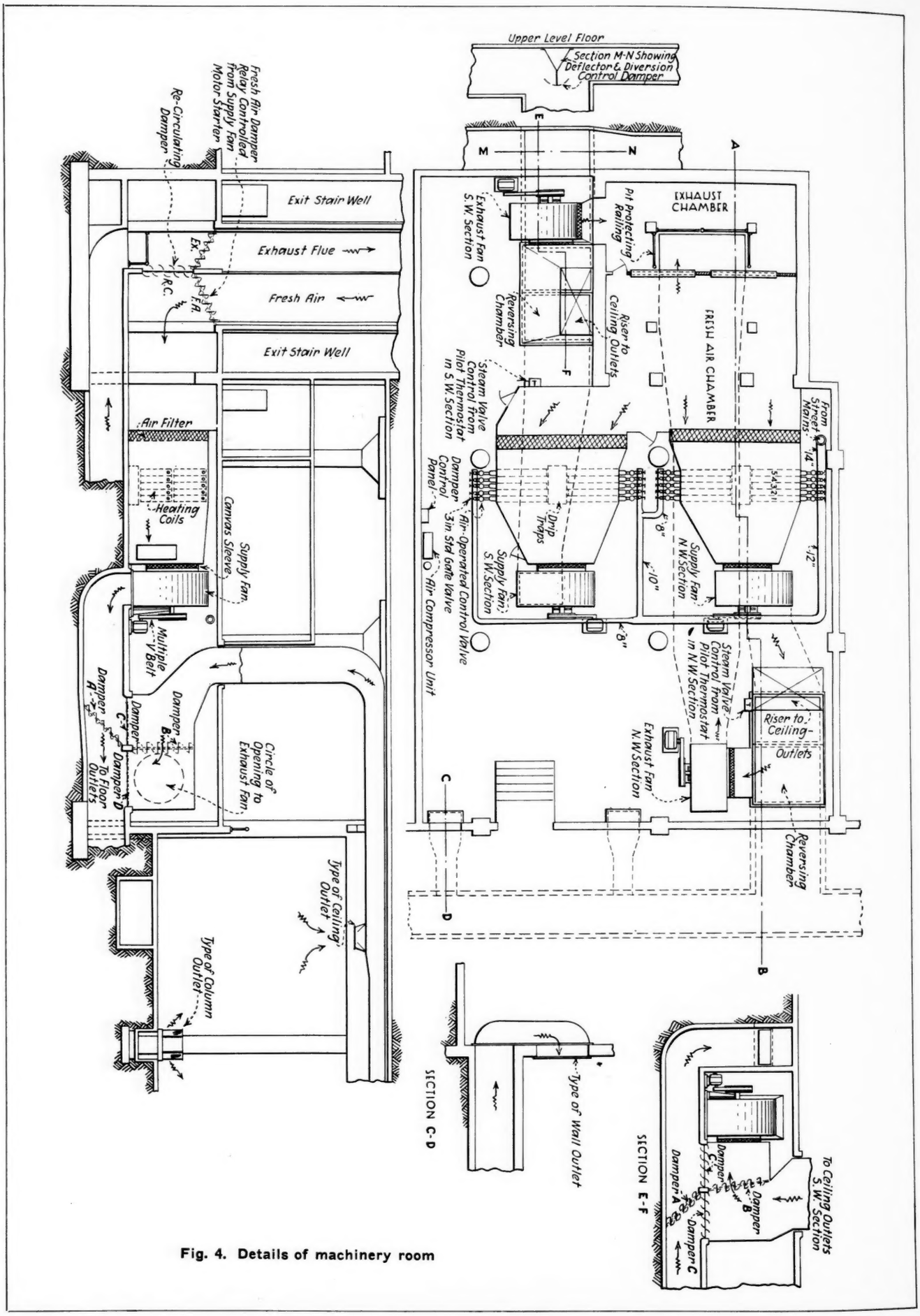


Fig. 4. Details of machinery room

in the building, depending on whether conditions at the moment require that fresh air be blown in at the floor or from the ceiling.

While the use of the building for exhibition purposes would under normal conditions require a floor-to-ceiling movement for air conditioning, the intention of the city management to make the building self-supporting, if possible, included a plan to use it as a public garage during such times as it was not engaged for exhibitions.

This made it necessary for the designing engineer not only to provide a down-draft to blow out the heavier-than-air monoxide gas from the floor outlets, but to take particular care that no dead pockets were left in the gaps of the forced circulation system, where this gas might settle and become a menace to health or comfort. This was solved by use of reversing chambers, shown in some detail in the lower view of Fig. 4.

The chamber is in reality four chambers separated by dampers of the shutter type, marked A, B, C and D. The lower two compartments, if unobstructed, are a continuation of the fresh-air circuit from the supply fans to the system of floor outlets. The upper two likewise are an integral part of the exhaust circuit from the ceiling ducts to the exhaust fans.

This condition holds if dampers A and B are open as shown and dampers C and D closed. Closing A and B and opening C and D connects the ceiling ducts to the supply fan and the floor conduits to the exhaust.

The system of reversing dampers is compressed-air-operated from a remote control panel. All four dampers operate as a unit, a movement of a single lever simultaneously opening A and B and closing C and D, or vice versa.

Switched systems of air circulation are admittedly nearly as old as the various methods of forced air conditioning by concurrent operation of a supply and exhaust unit. The claim for this design is simplicity of detail and control, coupled with the fact that the operating efficiency is in no way impaired by providing a dual selection of circuits.

Heating

Steam for heating is supplied by the mains of the Cleveland Electric Illuminating Company. As stated in the general description, a heating chamber is interposed in each of the four circulation systems ahead of the intake to the supply fans.

In each heating chamber are grouped five double stacks of steam coils, the stacks being independently connected, through both a compressed-air-actuated control valve and a standard gate valve for use in emergencies, to the steam supply.

One temperature control problem for this building was given special engineering attention. Since the building is an underground structure, conditions that made it certain there would be trouble from condensation on the walls and ceiling unless both the temperature and humidity of the circulated air were very closely controlled. This was handled as follows:

Specifications called for regulation of the room temperature between limits of 68°–70°. Midway of each of the four unit sections served by individual air circulating installations, there are four relay thermostats, each connected to its complementary temperature control panel located in the fan rooms, on which are assembled five relays operating separate air valves, these valves in turn being connected to the compressed-air-operated valves admitting steam to the coils in the heating chamber. The relays are adjusted to a temperature differential

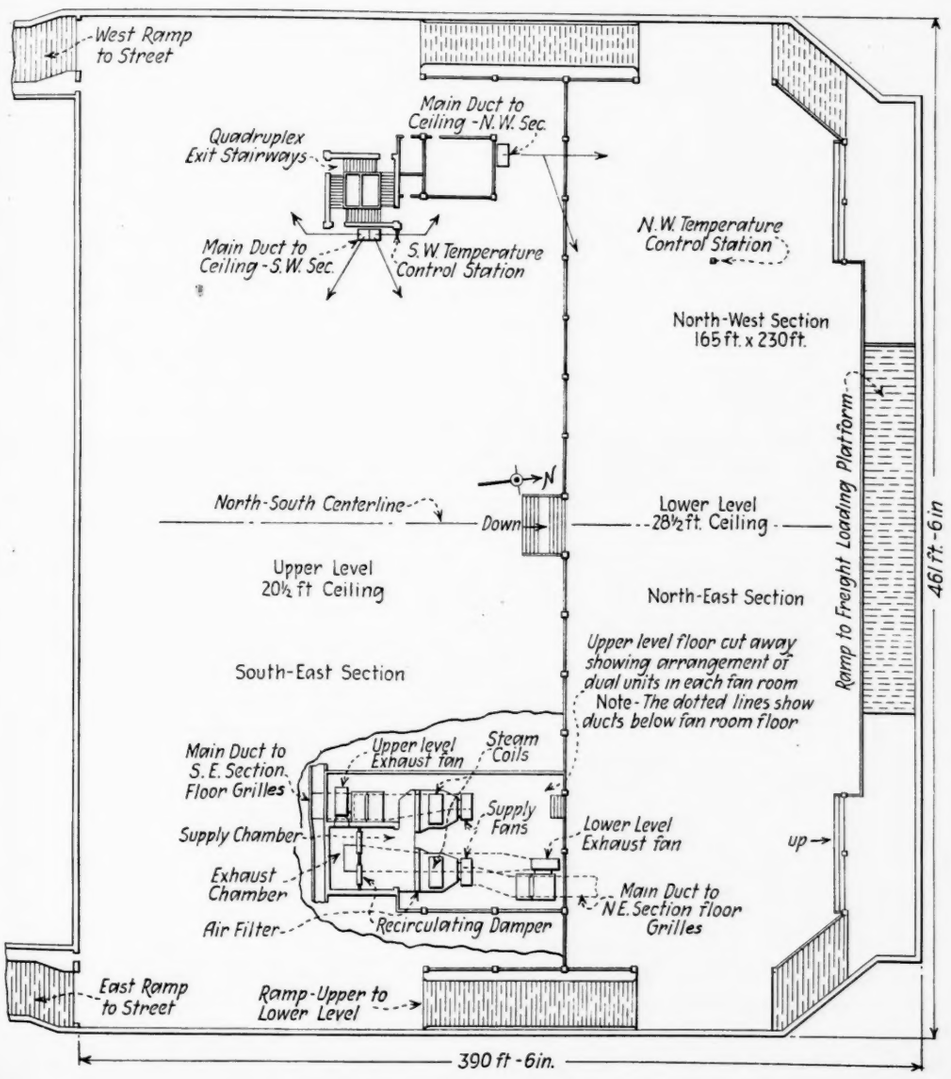

West Ramp to Street
Main Duct to Ceiling - N.W. Sec.
Quadruplex Exit Stairways
Main Duct to Ceiling - S.W. Sec.
S.W. Temperature Control Station
N.W. Temperature Control Station
North-West Section 165 ft. x 230 ft.
N
North-South Centerline
Down
Lower Level 28½ ft. Ceiling
Upper Level 20¼ ft Ceiling
North-East Section
South-East Section
Ramp to Freight Loading Platform
461 ft. - 6 in
Upper level floor cut away showing arrangement of dual units in each fan room
Note - The dotted lines show ducts below fan room floor
Main Duct to S.E. Section Floor Grilles
Upper level Exhaust fan
Steam Coils
Supply Fans
Supply Chamber
Lower Level Exhaust fan
up
Exhaust Chamber
Main Duct to N.E. Section Floor Grilles
Air Filter
Recirculating Damper
East Ramp to Street
Ramp - Upper to Lower Level
390 ft - 6 in.

Fig. 5. Plan showing division of Hall into two levels, with floor cut away to show apparatus below.

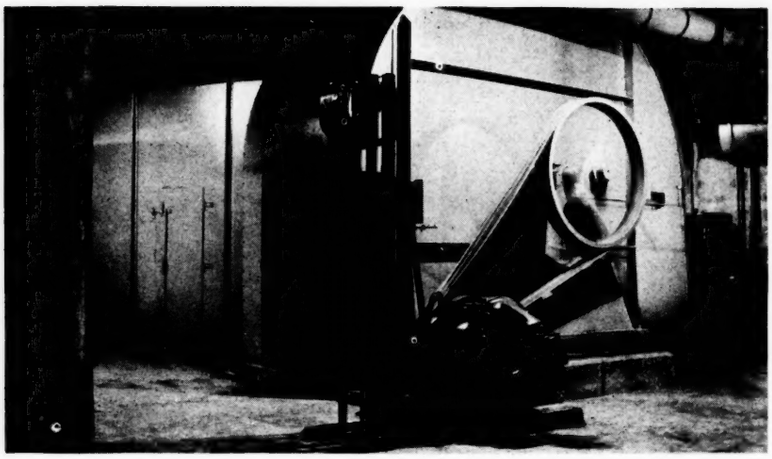


Fig. 6. View of one of supply fans

of ½° and on a drop of the room temperature to 70°, and below, will successively admit steam to the paired coils in the chamber, cutting in an added coil with each drop of ½°, until the fall in the room temperature is arrested or all five heating units have been cut in.

While it is not the present purpose to draw outside air into the building to the full capacity of the supply fans, when that air is at an unusually low temperature or saturated with moisture, sufficient coil surface area has been provided to raise the maximum capacity of each unit, from a temperature of zero to the limiting room temperatures specified, should any condition arise that made it necessary or desirable.

No special provision has been made by the engineer for control of the moisture content of the circulated air. It is believed it will be held within satisfactory limits by the automatic temperature regulation.

The Recirculating System

At the base of each pylon tower (Fig. 4) there is an arrangement of three recirculating dampers. Those marked FA and EX are interposed in the fresh air and exhaust flues, while damper RC is, when closed, a dividing wall between the fresh air and exhaust chambers. All three dampers are air-operated and each is independently controlled by levers on the damper control panels located in each of the two fan rooms. In abnormally hot or cold weather, or under conditions where humidity in the outside atmosphere is near the saturation point, it is the purpose to open damper RC and thus permit air from the exhaust ducts to by-pass back into the supply circuits.

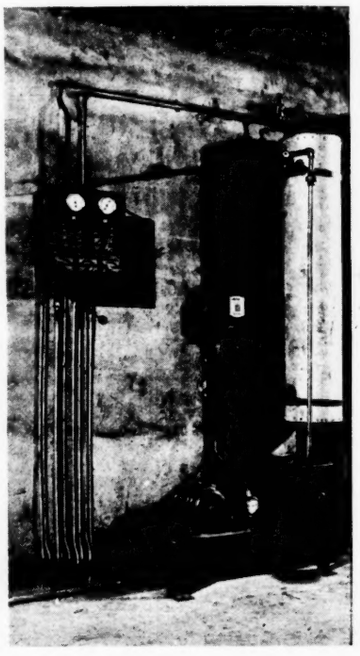
Other Features

With the uses which will be made of this building, other than for major exhibitions, a question of ultimate economy, it was necessary for the engineer to provide for the possibility that the structure might stand idle for varying periods, during which time it would not be profitable to operate the four systems of forced air circulation solely for the purpose of maintaining the building temperature above the freezing point.

To meet this possible condition, an auxiliary system of steam heat by direct radiation was provided. Radiators have been positioned along the outer walls and near the ramp and exit stairway openings, providing sufficient heating area to offset the calculated heat leakage at those points.

Under such conditions, there would be no necessity or economy in maintaining a room temperature of 68°-70° as regulated automatically by the thermostatic control, and to prevent the waste of steam by radiation from the coils in the heating chambers, the hand-operated valves controlling the admission of steam to the coils would be closed. Should the source of heat to the complex system of piping, including traps and returns, be shut off, their proximity to the fresh air flue was seen by the engineer to constitute a danger that near-zero air blown down the pylon flues under certain weather conditions, would damage the equipment and interrupt normal service by freeze-ups.

To make such a happening impossible, the supply fan motor starters have been equipped with an auxiliary relay that controls damper FA in the pylon flue. With the motor and circulating system inoperative, the damper FA is automatically closed, shutting off the fresh air and heating chambers from the outside atmosphere. The act of starting the motor opens the damper and vice versa.



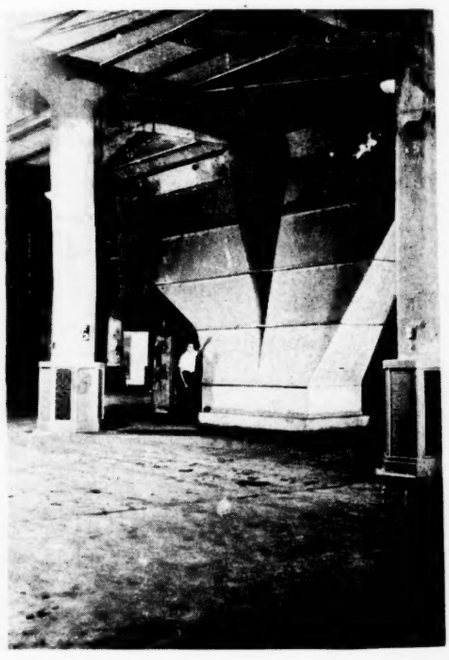


Fig. 7. (Left) Damper control unit. (Right) A view of one of the main ducts

Abstracts . . .

**Reviews and Summaries of. . . .
Current Papers, Books and Pamphlets**

Air Conditioning Fundamentals

Recognizing that for many readers the usefulness of many texts on heating, ventilating, and air conditioning is impaired because they undertake to cover too much ground, and because they are couched in highly technical phraseology, the author has endeavored to present the subjects of forced-air heating and air conditioning in simple, non-technical language, confining his discussions to those subdivisions of his subject necessary to a practical working knowledge.

In the early lessons the various quantities are defined, heat transfer and the B.t.u. method of determining heat losses from rooms are described. From here the author enters into a discussion of the development of the Standard Code. Computations of air quantities, pipe sizes, and the use of friction and furnace heating charts are taken up in following chapters.

In the concluding lessons, the effects of humidity on comfort are discussed, along with a simple explanation of the physical quantities involved in the measurement and control of relative humidity. A lesson is devoted to an explanation of the psychrometric chart and its use, and the final chapter outlines considerations to be applied in selecting equipment.

[*"First Steps in Air Conditioning," by A. J. Mellish; published by Edwin A. Scott Publishing Co., Inc., 45 West 45th St., New York; 85 pages; 6 in. × 9 in.; fabric bound, $2; paper bound, $1.00.*]

●

Air Moisture Best Index of Air Change and Distribution

One method of determining the rate of air change in an enclosed space is by analyzing samples of air, CO_2 concentration being a measure of the air change. Unfortunately, it is quite difficult to obtain representative samples, to preserve these samples during transportation to the laboratory for analysis, and finally to make the analysis itself.

There are, however, other indices of air change and distribution in occupied spaces, such as the quantity of heat given off by the occupants, which increases the dry bulb temperature, and the quantity of moisture given off by the occupants, which increases the wet bulb temperature. Therefore, both dry and wet bulb temperatures are indices which might be used.

This paper is a report of a study made by Houghten and Blackshaw of the advantages and accuracy of each of the three methods. They found that the moisture method gave greater consistency than the CO_2 method, and further that use of the sling psychrometer, used with the moisture method, is far easier and simpler to handle, and readings can be made much more quickly than when using the CO_2 method.

Other conclusions were that with dry bulb temperatures around 75° air changes of at least 10 c.f.m. per occupant are necessary to prevent pronounced odors. An air motion of from 20 f.p.m. to 50 f.p.m. is a possible index of satisfactory air distribution.

[*"Indices of Air Change and Air Distribution," by F. C. Houghten and J. L. Blackshaw. Presented at the June, 1933, meeting of the A.S.H.V.E.; 6½ pages; 5 graphs.*]

●

Heat Transfer in Heating and Ventilating Practice

A review of available data on rates of heat transfer through heating surfaces of heating boilers, radiators, oil-burning boilers, gas-burning boilers, and building walls has been made by F. C. Houghten in a recent paper presented at the Heat Transfer Symposium in New York. Four valuable tables summarizing these data are included, covering boiler heating surfaces at different rates of fuel burning for hard and soft coal and coke; similar data for automatically-fired devices; radiators, and mechanical convectors.

[*"Heat Transfer Rates in Heating and Ventilating or Air Conditioning Practice," by F. C. Houghten. Presented before the annual meeting, A.S.M.E. Heat Transfer Symposium, New York, December, 1933; approximately 3700 words, 4 tables.*]

●

Advantages of Anthracite

Introduced by a brief general discussion of anthracite, touching on the history, geographical distribution, reserves, preparation, and classifications of this fuel, this paper presents the results obtained in tests of anthracite in comparison with competitive fuels at the Anthracite Institute Laboratory.

It was found at the laboratory that other house heating fuels produced from 3 to 443 times as much solid matter by volume as anthracite. The stack solids produced from the combustion of anthracite were comparatively heavy and tended to fall back into the chimney. In this connection, it was also shown that the fly-ash from anthracite fires contains no oily or sooty material, and does not stain and discolor as do the products of combustion of other fuels.

Further tests were run to demonstrate the superiority of anthracite as a producer of even heating effect. This was shown particularly to be the case when an-

thracite was tested in competition with by-product coke, anthracite producing a more constant degree of heat over a longer period of time and requiring less firing attention.

Fuel oil and coal are compared economically, the results being tabulated to indicate an annual saving in favor of anthracite, both when hand-fired or magazine-fed. The cost analysis includes all fixed and operating costs which must be charged to the burning of both fuels, and annual costs for both fuels are tabulated for different oil and anthracite unit prices.

A discussion of the convenience of anthracite as a heating fuel concludes the paper. This contains a general description of the various equipments for the automatic firing and ash removal of anthracite fuels.

[*"The Advantages of Anthracite as a Domestic Fuel," by Allen J. Johnson. A paper presented before the Coal Division, American Institute of Mining and Metallurgical Engineers, Columbus, Ohio, October,* 1933; *approximately* 6000 *words,* 8 *tables.*]

●

Effects of Humidification in Textile Plants on Workers' Health

A report has been issued by the Public Health Service on the health of workers in the carding, spinning and weaving rooms of a cotton cloth manufacturing plant. The investigation included an occupational analysis, sanitary survey, determination of dust concentration, study of humidity conditions, and sickness records.

The study gives a fairly accurate picture of the temperature and humidity conditions which one may expect to find in a textile plant in the southern states in which air conditioning (apart from the introduction of moisture) is not used. In spite of the uncomfortable conditions demonstrated to exist, especially in the weaving rooms, no definite effect on health was established. Thus the observation by English investigators to the effect that there was no excess of sickness in the humid sheds as compared with the nonhumid sheds seems to be borne out in this study, although workers in this investigation were exposed to a much more severe condition of temperature and humidity.

The most important specific findings are as follows:

All room-groups show distinctly lower temperatures in the winter; but it is notable that the averages even in winter are never less than 80°.

As would be expected, in view of the use of artificial humidification in the weaving rooms, a much higher relative humidity (about 85%) was found in these rooms than in the others (52 to 58%).

During the summer the average effective temperature in all the rooms showed a condition which would be expected, on the basis of comments in the literature, to have a bad effect on health. The winter readings in the weaving rooms are of the same magnitude as the summer readings in the other rooms.

The rate of illness for cases of all durations was higher than that found in other studies of this nature. However, the rate of cases of eight days' duration and longer and for serious conditions (such as tuberculosis, pneumonia, etc.) was very low. The sickness rate was definitely higher for night workers than for day workers.

From the physical examinations the only respiratory rate showing percentages of striking nature is that of nasal pharyngeal catarrh (from 22 to 45% by room). There was a definite tendency for the workers to be under the average weight of American industrial workers. This tendency was not more pronounced, however, with increasing length of service.

[*"The Health of Workers in a Textile Plant," by R. H. Britten, J. J. Bloomfield, and Jennie C. Goddard. U. S. Public Health Bulletin No.* 207, *July,* 1933; *obtainable from the Superintendent of Documents, Washington, D. C.*]

●

Investigators Study Thermal Properties of Wood

The thermal properties of wood are of importance, both in building construction to conserve fuel and in the field of refrigeration. In 1929 a preliminary study of this subject was made, and more recently the project was extended to cover about 30 species of wood, particular attention being paid to the effect of density and moisture content on thermal conductivity of several species. The work has recently been reported in a paper by F. B. Rowley.

It was found that those species which have the greatest increase in density for a given increase in moisture also have the greatest increase in conductivity for a corresponding increase in moisture.

Tables in the paper show the conductivity of the numerous samples as tested as well as corrected figures for 0% moisture and for 12% moisture, while the density-conductivity relationship for the species are shown graphically.

[*"The Heat Conductivity of Wood at Climatic Temperature Differences," by F. B. Rowley. A joint report of the University of Minnesota, A.S.H.V.E., and National Lumber Manufacturers Association;* 11 *pages, including* 3 *pages of tables and* 32 *graphs.*]

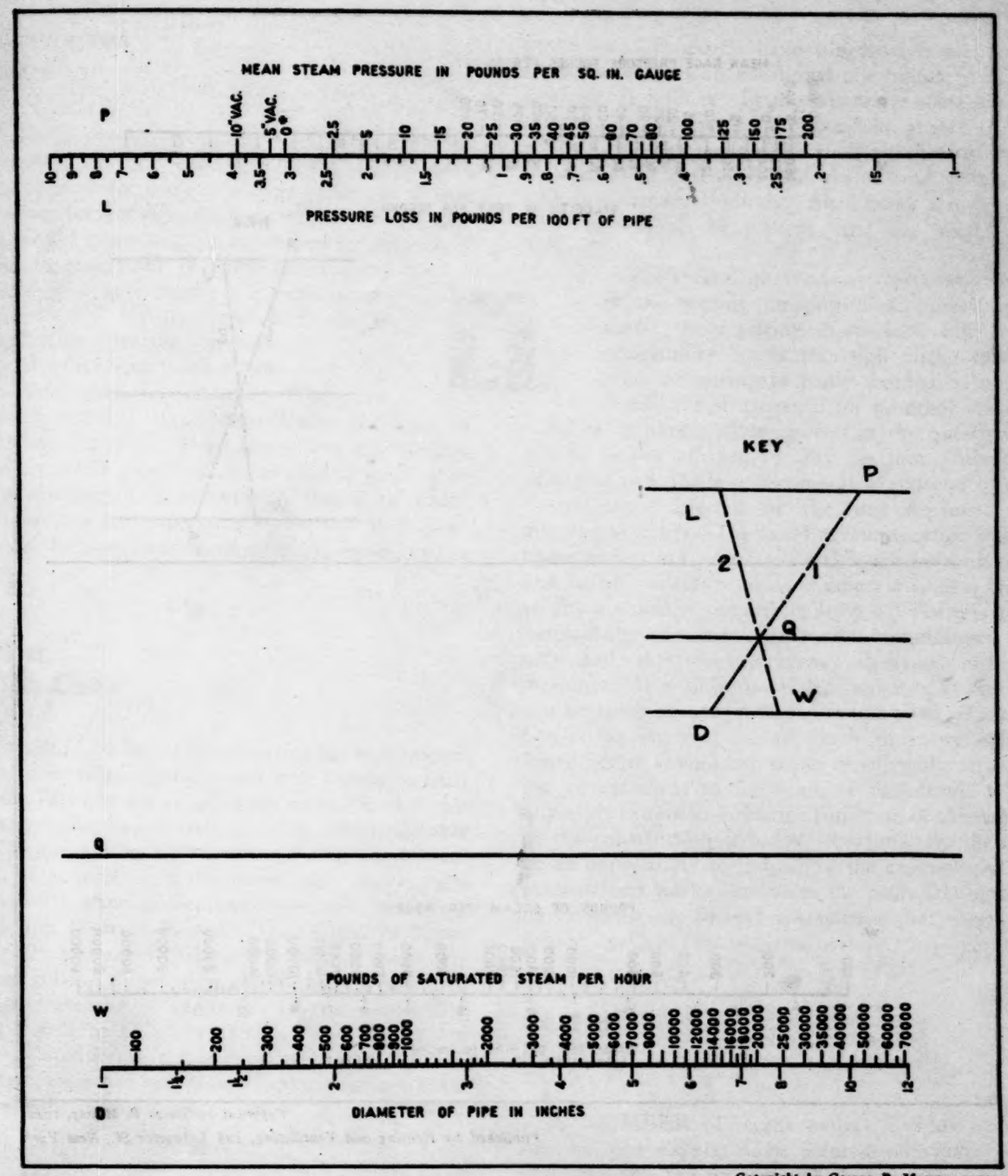
●

A. S. H. V. E. Issues Research Directory

The 1933 Directory for the Correlation of Thermal Research has been issued by the Research Laboratory of the A.S.H.V.E. Listed in the booklet are university laboratories, private laboratories, government bureaus, trade associations, and other organizations engaged in, supporting, or otherwise interested in research, codification, standardization, or improvement of practice in the field of thermal engineering with specific reference to heating and ventilation and their relation to human comfort and health.

["1933 *Directory for the Correlation of Thermal Research," published by the Research Laboratory, A.S.H.V.E.,* 4800 *Forbes St., Pittsburgh, Pa.;* 6 *in.* × 9 *in.;* 28 *pp.; paper-bound.*]

PRESSURE DROP IN STEAM PIPE LINES



Copyright by George B. Massey, 1932

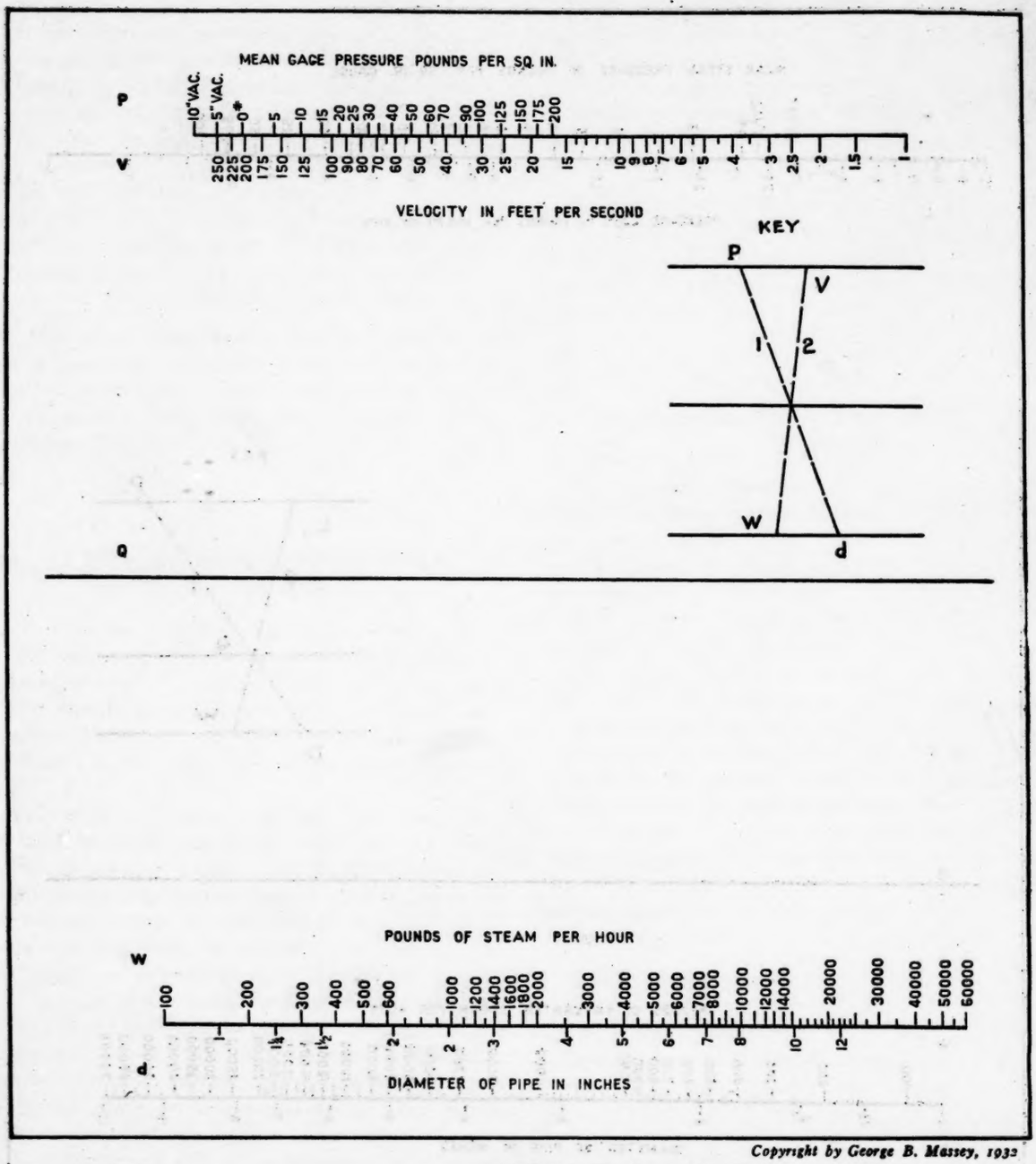
Published by Heating and Ventilating, 148 Lafayette St., New York

The above nomographic chart, based on Babcock's formula, saves much tedious computation in determining the pressure drop in saturated steam, when a certain quantity is passing at a given mean pressure through a pipe of known inside diameter.

To find the difference in pressure, in pounds per square inch, at the two ends of the pipe, a straight edge is laid through the mean steam pressure on scale P, and the inside diameter of the pipe on scale D, locating a point on the index Q. The straight edge is then laid so that it intersects this point on Q, and the number of pounds of steam per hour on scale W, the required pressure drop being the intersection of this line with scale L.

H. & V.'s REFERENCE DATA—23

VELOCITY OF STEAM IN PIPES



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Published by Heating and Ventilating, 148 Lafayette St., New York

This chart, based on a formula found in *Steam*, published by The Babcock & Wilcox Company, provides means for rapid determination of the velocity of steam in a pipe, when a certain quantity is passing at a given pressure through a pipe of known inside diameter.

A straight edge is passed through the known mean pressure on scale P, and the known inside pipe diameter on scale *d*, intersecting a point on index Q. The straight edge is then passed through this intersection on Q and the known weight of steam per hour on W, and the required velocity is then read at the intersection of this line with scale V.

EDITORIALS

Code Deserves Support

THE administrative work involved in interpreting and explaining a code covering 12,000 dealers and hundreds of manufacturers is a large order. If to this are added the further difficulties caused by the fact that the code, unlike most, contains provisions for the collection and dissemination of price information under open price agreements, it is understandable that the Oil Burner Code Authority is confronted with a tremendous task.

One of the problems faced by the Authority is that of educating the industry to the point where every member stands agreed that the aims of the Code are desirable. Since these aims are to eliminate unfair trade practices, price cutting, and other forms of chiseling, this cooperation should be forthcoming. Failure to cooperate carries with it responsibility for the continuation of present uncomfortable conditions.

●

A Million Users of Coke

THAT solid fuel for building heating has had tougher competition in recent years is too well known to need comment. What is not so generally known is that this very competition has served to bring about notable changes in the methods of using coal and has accompanied a great increase in the use of coke. Stoker sales in the smaller sizes in September of this year were nearly double those of August. The Bureau of Mines also recently estimated that over a million homes are now using coke as a fuel. Use of coke is also estimated to have increased 250% in the last 10 years, with 1932 showing a gain of 11% over 1931. These figures are but two isolated items in this rapidly changing picture. They illustrate what may easily become a permanent and increasingly important trend.

●

Public Works

A CHECK-UP of the allotments of funds made under the three billion dollar public works funds shows that approximately 10% has been devoted to building construction of all kinds. Most of this money is not yet spent because the projects have not reached the construction stage. Nearly all is expected to be used during the coming calendar year. Its expenditure will give a much-needed volume to the building construction field next year.

Now that the fund is approaching exhaustion, proposals are appearing looking toward either expanding the present fund by action of Congress or authorizing a new one. Proposals have suggested figures varying all the way from an additional one billion to as much as six more billions. In the meantime some are questioning the wisdom of the outright grants of funds which have been made while another school of thought is advocating extending the grants and doing away with the loan idea entirely. Also, many are wondering why the use of the present fund has been so long delayed.

The several questions are certain to come up in the coming meeting of Congress and no doubt the resulting discussions will give an opportunity for a thorough airing of views. Such an airing is badly needed in order to clarify the situation, if for no other reason.

All of us have a close interest in the questions and will be vitally affected by any decision. Admittedly, extensive new funds will come as a godsend to an industry worse affected by the long depression than almost any other. The building construction industry, however, has not advocated and is not now advocating any selfish advantage to itself unless it is clear that the results are also in the public interest. There is general agreement that a certain amount of stimulation is necessary and that the emergency demands emergency measures. It is quite possible, though, that too much can be spent on public works at one time. This question is the essential one to which an answer must be found before anyone can either intelligently set a figure for an extension to the fund, or can decide whether any such extension is justified in spite of the condition of the construction industry. Fortunately, there may be an opportunity to judge how the expenditure of the present fund works out before the proposals looking to its extension are in such a condition that they can be passed by Congress.

●

Cost of Building

A NUMBER of recent writers, including at least one housing expert, have pointed out that building materials still remain too high in cost. The commentators suggest that the failure of these goods to align themselves with other commodities results in an unwillingness to release capital for building.

Possibly so. But the charge of too high prices cannot be brought against costs of heating materials. The purchasing power of the 1926 dollar in August for these goods was $1.42. That is, we could then buy $1.42 worth of heating goods with our 1926 dollar. Our 1926 dollar would buy only $1.23 in brick, $1.11 of cement, $1.26 of lumber, $1.29 of paint, and $1.18 of other building materials. Our heating dollar at $1.42 compares with a cost-of-living dollar of $1.44.

Heating goods have dropped in price with the cost of living. Other building materials are not in line.

Business

A summary of business reported for recent months follows. The direction in which business has moved is as compared with the previous month:

October

New Building ..... Up
Employment in plants making heating equipment ..... Down
Wholesale prices of heating equipment ..... Same
General business ..... Down

September

Cost of Building ..... Up
Oil burner sales ..... Up
(but increase less than usual seasonal gain)
Stokers ..... Up
(increase sharp, and greater than usual seasonal gain)
Blowers ..... Down
Unit heater sales ..... Down
Unit ventilator sales ..... Down
Steel boiler sales ..... Up
(with increase more than usual seasonal rise).

August

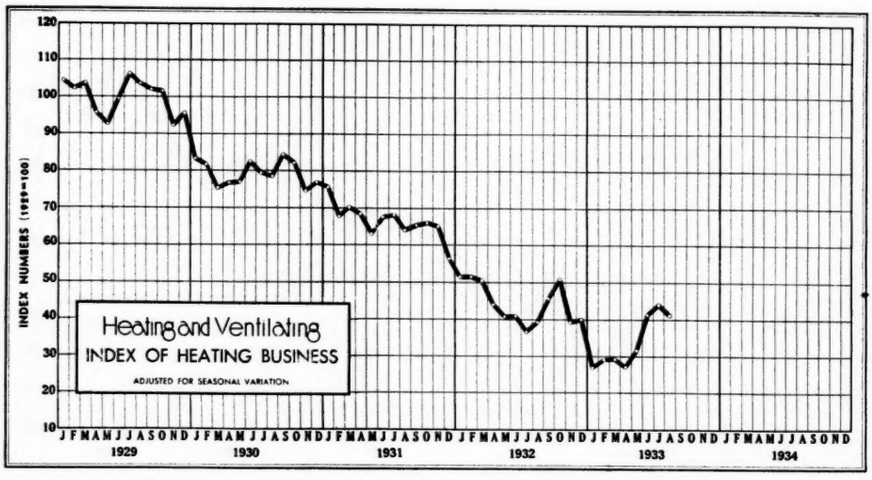
H. & V.'s Index of Heating Business Activity ..... Down
Cast-iron radiator sales ..... Up
(but increase less than usual seasonal gain).
Cast-iron boilers ..... Up
(but gain less than usual seasonal increase).

"Unconvinced," according to H. I. Phillips, is a gas furnace owner who simultaneously receives his gas bill and reads in the paper that the gas company is losing money.

Evidently the manufactured gas rates for house-heating, reported as on the way down, are not going down far or fast enough. The A.G.A. statistical department says that in August there was a 3.9% drop in the number of house-heating customers from August, 1932.

However, the gas heating crowd can derive some comfort from *Gas-Age Record*. That paper made an elaborate statistical study of the declining birth rate, and arrive at the conclusion that in the future the average age will be higher, that these more mature people will be more keen about home comforts, and that gas heat will supply this comfort.

Over 20 million square feet of cast-iron direct radiators were sold in the first eight months of 1933. During the same period, over 1.5 million square feet of non-ferrous convectors were sold, valued at $400,000. In addition, $61,000 worth of cast-iron convectors were sold.


INDEX NUMBERS (1929=100)
120
110
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Heating and Ventilating
INDEX OF HEATING BUSINESS
ADJUSTED FOR SEASONAL VARIATION
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1934

Activity in the heating trade, as indicated by HEATING AND VENTILATING'S Index of Heating Business, declined in August to 41.2% of the 1929 average, after adjustment for seasonal variation, as compared with 45.0% for July.

Summary of index:

August, 1933 ..... 41.2
July, 1933 ..... 45.0 (Revised)
August, 1932 ..... 39.4

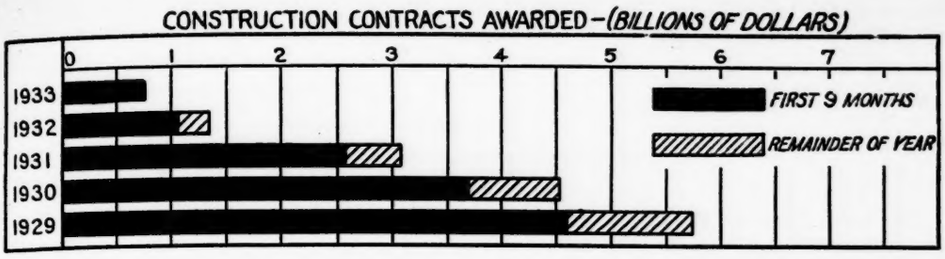
A Dr. Eldorado Uber called on Secretary Wallace at Washington recently. The doctor had a cure for agricultural maladies. The cure was rhythmic dancing, to be taught so that the farmers' social outlook could be improved. There is, he claimed, a close connection between rhythm and economics.

Thomas M. McNiece, a New York market analyst, thinks so too. In a recent paper on Rhythmic Variations in Industry, he shows that the production curves of textile, food, automobile, and construction industries are, to use an electrical analogy, all out of phase with each other. None of them alone agrees with the curve of combined business activity. He then shows that the resultant curve of the four industries agrees almost exactly with the general business curve. His conclusion is that these four industries are the major components of business, and that other businesses meekly follow along.

The rhythm in the curves comes from the replacement demand. The peak in the construction curve occurs about every 21 years—the replacement life of a building. For autos the replacement occurs in three years, with an ultimate life of seven years. When the replacement periods for the four industries correspond we have a boom. When the valleys of each of their curves come at once we have a depression.

Earle Bailie, investment banker and lawyer, recently appointed Special Assistant to Secretary of Treasury Morgenthau, is a director of the Minneapolis-Honeywell Regulator Company.

The Donetz Basin, Russia's "Pennsylvania" coal fields, is now producing over 120,000 tons of anthracite per day . . . . Modern apartments in Moscow broke records this fall when steam was turned on in modern apartments November 1 instead of the usual November 7. Apartments were heated every second day since October 15.



Status of the construction industry for the first nine months of this year. The building industry figures are included.

Insolvency figures for the heating and plumbing trade, as compiled by Dun & Bradstreet, Inc., are given below. Figures for 1933 are for January to October, inclusive:

Manufacturers

Year	Number	Liabilities
1930	1	$7,800
1931	2	49,300
1932	8	830,186
1933	10	3,770,896

Jobbers, Contractors and Retailers

Year	Number	Liabilities
1930	20	$484,400
1931	21	476,749
1932	66	2 214,639
1933	59	2,511,459

Building contracts for October, reported by F. W. Dodge Corporation, for 37 states amounted to $145 million, as compared with $123 million for September and $107 million for October last year.

Every year the Detroit Real Estate Board prepares a table showing the cost of erecting different kinds of buildings in that city, expressed in cents per cubic foot. A summary of these costs is shown below. The lower figure is ordinary construction, the higher, fireproof construction. Schools and hospitals are shown only for fireproof construction.

Type	Cents per Cu. Ft.
Factories	7 to 14
Stores	16½ to 18½
Churches	18½ to 22½
Theaters	18½ to 22½
Office buildings	21½ to 32½
Hotels	21½ to 37½
Schools	27
Hospitals	27¾
Steel buildings	6½ to 10
Apartments	21 to 34
Residences	14 to 25½
Garages	6½ to 15½
Service stations	21½

The data are as of January, 1933.

Coke has been slowly but steadily increasing in popularity as a domestic heating fuel. Following are Bureau of Mines figures which show the trend:

Year	Tons
1923	2,733,000
1927	4,800,000
1929	7,500,000
1930	8,028,000
1931	8,495,000
1932	9,422,000

Building permits from 758 cities for non-residential buildings increased 2.2% in October over September, while those for residential buildings declined 39.9%. Contracts for Federal buildings for October totalled $14.5 million.

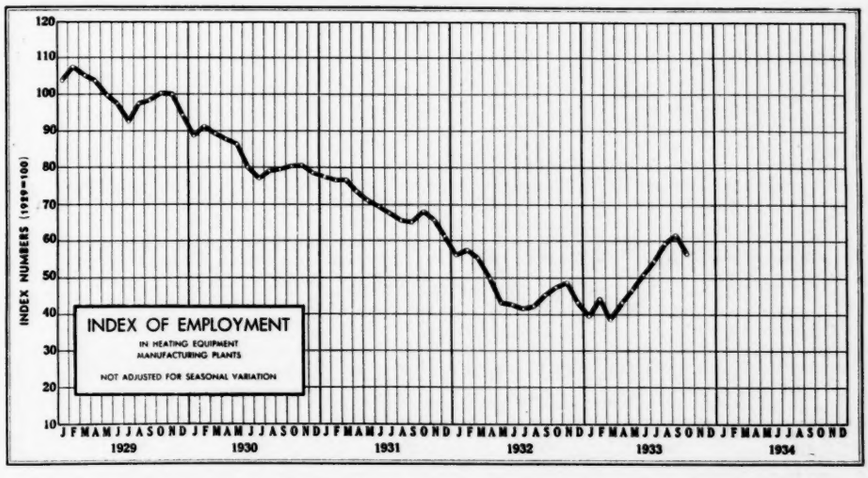
Indications are that building for the next six months will consist largely of public buildings and that residential building will largely be of the apartment-house type capable of housing many families. These apartments will be built by private corporations with Federal funds and by the Federal Emergency Housing Corporation, also using Federal funds.

The Home Owners' Loan Corporation completed 6942 Loans totaling $20.3 million up to November 10. Loans tentatively approved numbered 125,631, amounting to $357 million.

While we were roasting in July, Nome, Alaska, was piling up 542 degree-days!

Industry and trade generally seem to be moving toward adoption of uniform cost accounting methods. The advantages of uniformity are said to be two: (1) to improve competitive conditions by providing basic cost information on which to develop adequate price policies within an industry, and (2) to increase operating efficiency through the development of a more intimate knowledge of costs, and through comparison of the performance of individual companies with the average of normal results for the industry.

In order better to acquaint business men with this subject, the Metropolitan Life Insurance Company has prepared a report entitled "Uniform Cost Activities in Trade and Industry." It is the result of a review of the uniform cost experiences of more than 76 trade associations and sets forth, as well, the opinions and ideas of a number of responsible executives in a wide variety of industries.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J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1929
1930
1931
1932
1933
1934

Factory employment in the heating industry is shown above. The figures are from the Department of Labor index, recomputed to 1929 = 100.

October, 1933	44 6
September, 1933	48 3
October, 1932	37.3

Your Everyday Problems

HEATING AND VENTILATING will be glad to answer your problems relating to installation and operation of heating and ventilating systems. Letters will be answered promptly, and in some cases published anonymously. If sketches are included they should be clearly drawn. Write The Editor, HEATING AND VENTILATING, 148 Lafayette Street, New York.

QUESTION 105. *Is it better to add moisture to the air for humidification by vaporizing it or by breaking it up into a fine mist or spray by mechanical means? Which method adds more humidity to the air?*

K. M. G.

ANSWER: The two methods of humidification both accomplish exactly the same ultimate result, and air properly humidified by either means is equally healthful to breathe. In the one case, the natural tendency of water to evaporate when surrounded by air that is above the dewpoint temperature is accelerated by heating the water, and in the other the same evaporation is accelerated by breaking the water up into a mist composed of minute droplets, thereby increasing the amount of surface in contact with the air. The only determining factors to be considered in the selection of the humidifying means to meet a given requirement are convenience and cost.

Both methods are equally capable of control and regulation, assuming the equipment installed to be of adequate capacity. The problem is, of course, not to add the greatest amount of moisture to the air, but to add just sufficient moisture to maintain the correct relative humidity as governed by the conditions of dry bulb temperature and air motion.

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QUESTION 106. *What is a proximate analysis of coal, and how does it compare with the ultimate analysis? What is the value of the proximate analysis?*

W. R. G.

ANSWER: The ultimate analysis of a coal reports the percentages by weight in which the elementary constituents of the coal are present. These constituents include carbon, hydrogen, oxygen, nitrogen, sulphur, and ash. The proximate analysis gives simply the weight of fixed carbon, moisture, volatile, and ash present in a given sample of the fuel. These quantities are easily determined by warming the sample to a certain specific temperature to evaporate the moisture, heating the sample without oxygen to distill off the volatile, and completely burning the remaining solid in oxygen to determine the fixed carbon and ash.

The proximate analysis is of great value because it permits a ready estimation of the calorific value of a given fuel as fired without recourse to a chemical analysis, requiring the services of an experienced chemist.

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QUESTION 107. *Is the heat transmission of a radiator affected by placing it in an open wall recess?*

M. J. L.

ANSWER: If a radiator is placed in an open recess, with the front face of the radiator flush with the face of the wall, the heat transmission rate of the radiator will be decreased by an amount depending upon the space between the rear of the recess and the radiator and the distance between the top of the radiator and the top of the recess.

For maximum efficiency, it has been found that a recessed radiator should be kept 2½ in. away from the rear of the recess. The space between the top of the radiator and the top of the recess should be at least 3 in. With the space at the top 3 in., the minimum allowable, a reduction of 8% in the heat transmission should be made.

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QUESTION 108. *What is the amount of cooling effect obtained from melting of 1 lb. of solid carbon dioxide (dry ice), and at what temperature does this substance melt?*

L. H.

ANSWER: Carbon dioxide, unlike water, cannot exist as a liquid at atmospheric pressure, and dry ice therefore sublimates, or passes directly from a solid to a vapor. For a normal pressure of 14.7 lb. this sublimation takes place at — 109°, and 248 B.t.u. are absorbed per pound of carbon dioxide sublimated. In addition to the refrigerating effect due to the change in state, 27 B.t.u. are absorbed in warming the vapor from the sublimation temperature to 32°. Therefore, 275 B.t.u. of refrigerating effect results from the changing of 1 lb. of solid carbon dioxide at — 109° to vapor at 32°, an amount nearly twice that obtained from the melting of 1 lb. of ice to water at the freezing point.

News of the Month

Oil Burner Code Authority Outlines Accomplishments

A six-fold program for stabilizing the oil burner industry as projected by the Oil Burner Code Authority was outlined to an informal trade press conference in New York, December 5, by Assistant Deputy Administrator Schwan of the NRA and by Morgan J. Hammers, chairman of the Code Authority. Highlights of Code Authority up to Dec. 4 include:

1. Under the open price plan of the Code, there has been an exchange of 33,000 sets of price data among 265 manufacturers.

2. The decentralization program for effecting a greater degree of local compliance has resulted in the zoning of the entire country into 462 competitive sales areas which immediately are to come under the local jurisdiction of groups of five governors to each territory, one in each group being the zone chairman and responsible directly to the Code Authority. Under this plan the huge task of distributing prices to dealers and distributors involving the issuance of some 300,000,000 sets of price data among 18,000 local outlets will be reduced to a practical and workable minimum, this work being already under way.

3. Establishment of a uniform accounting system for the industry under development by an accounting firm will be completed about January 1.

4. There have been highly constructive and satisfactory conferences with the National Retail Drygoods Association and with the industrial oil burner manufacturers looking toward a solution of problems affected by several codes including the oil burner code, which is a so-called vertical code affecting all units engaged in the oil burner industry.

Mr. Schwan, after relating the Washington viewpoint with respect to the Code Authority's work, read a letter which he had addressed to Mr. Hammers and which commended the Oil Burner Code Authority for the forthright manner in which it had undertaken and progressed with the program.

Chicago Conference Discusses Housing

A unified policy on housing, national in scope, and comprising five distinct lines of action, was adopted at the conference of the National Association for Better Housing, held October 31 and November 1 at the Union League Club, Chicago.

The five-point housing plan, turned over by the conference to the governing council for action, contained the following recommendations:

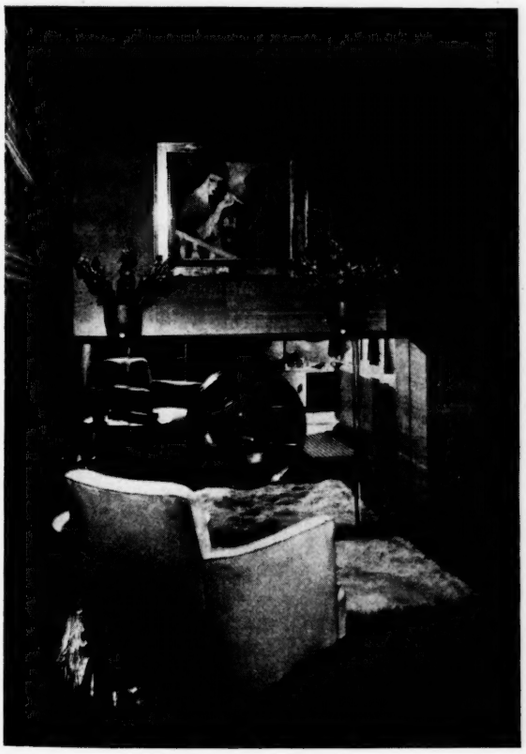
1. That there be established some agency for serving as a clearing house of information between the several branches of the industry.

2. That steps be taken at once to institute a market study of the home building field, with a view to ascertaining in a thorough and scientific way the nature of the public's wishes as to the kind, type, and location of homes desired.

3. That a special committee be promptly established to consider what steps may be taken to speed up the volume of modernization and rehabilitation during the coming winter.

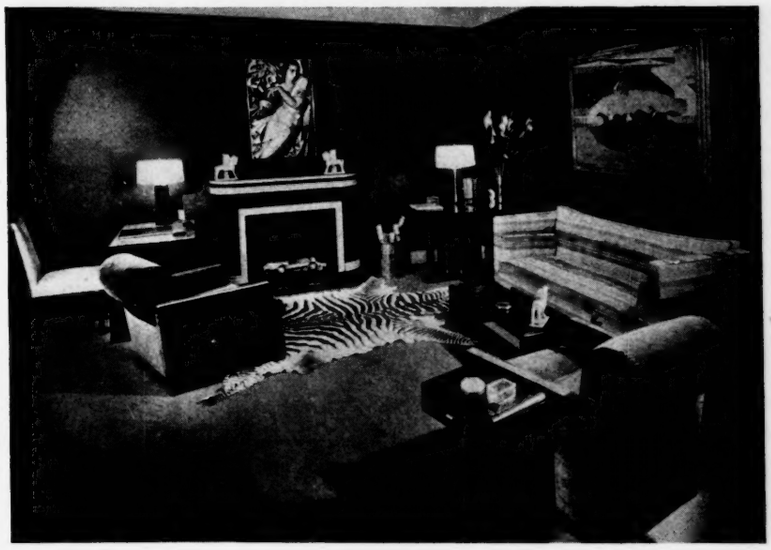
4. That particular attention be given to extending the type of housing project proposed by the Mayor of Euclid, Ohio, laid before the conference by Robert D. Kohn, Federal Housing Director.

5. That the relation of housing to community planning be emphasized and in order to facilitate the de-



A STEP FORWARD IN LIVING!

An electric heating element installed as part of a mirror mantelpiece was one of the features of the "Forward House," built and furnished by R. H. Macy & Co., New York, and opened for inspection in the company's department store. This house was tastefully decorated throughout in the modern style, examples of which can be seen below in the view of the living room, and in the corner of the bedroom, left, showing the mirror mantelpiece.



velopment of comprehensive community plans, the conference recommends to the Federal Public Works Administrator that the function of planning itself be recognized as a public work, and as such, eligible to receive grants and loans.

Establishment of a Federal Mortgage Discount Bank, to function in the field of long term credit as does the Federal Reserve Bank for short term credit, was urged in the report of the Conference Finance Committee, which the conference adopted unanimously.

Hospital Expert Speaks to New York Group

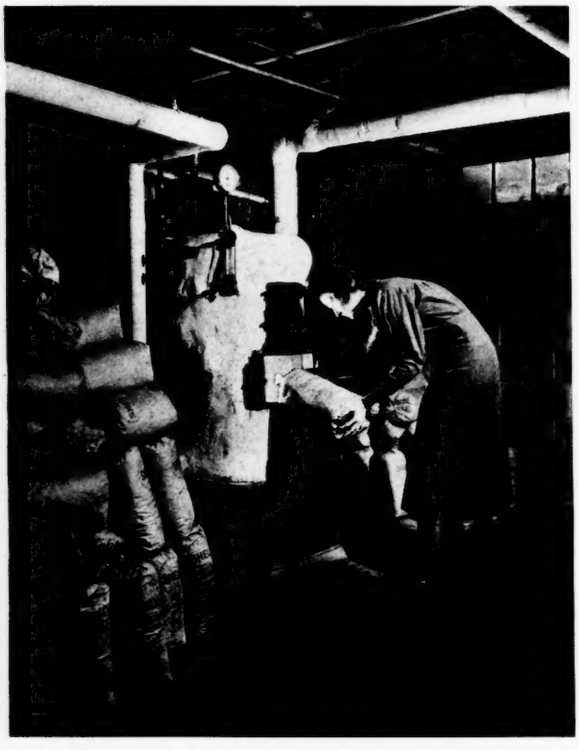
Inclusion of useless and expensive mechanical equipment in plans for hospital plants was condemned by Charles F. Neergaard, hospital consultant, in a talk before the N. Y. Chapter of the A.S.H.V.E., November 20.

Mr. Neergaard, speaking from the standpoint of those who buy and operate the equipment, reviewed an impressive number of installations where money which the hospital can ill afford has been spent on ventilating rooms and areas where ventilation is not needed, for thermostats in sterilizing rooms and laundries where the temperature can not be controlled anyway, and similar examples of poor design. Other cases cited by the speaker included two hospitals with identical sized rooms where 62 sq. ft. of radiator were installed in each room, while in the other building 38 sq. ft. worked satisfactorily.

A recommendation was made to heating engineers that duplicate scrapbooks be gotten up for the superintendent, operating engineer, and the designing engineer in which copies of instruction sheets supplied by the manufacturers of the different items of mechanical equipment can be pasted and preserved for use when trouble is experienced. The speaker also urged that the plans be revised when the building is completed so that they show where pipe lines are actually installed, so that "one of the most popular hospital pastimes, mining for leaks, will be reduced to a minimum."

W. T. Jones, national president of the A.S.H.V.E. spoke on "The Status Quo of the Society," in which he discussed the financial, membership, personnel, and research situation of the organization. He presented a convincing analysis of the returns a member receives for his dues.

Approximately 70 members and guests were present.



Distributors in St. Louis are selling Shell coke in packages which are charged into the heater without opening. The individual bags weigh 15 to 20 lb. Service will undoubtedly be extended to other territories soon.

Simplified Forced-Air Code

A booklet "Simplified Code and Installation Rules for Air Conditioning Systems" has been prepared by The Fox Furnace Co., Elyria, Ohio, Division of American Radiator & Standard Sanitary Corporation. The material in the booklet is supplied with the idea of assisting the heating contractor in calculating and designing the smaller and less intricate types of air conditioning systems, and is intended to serve until such time as the heating contractor can familiarize himself with more advanced methods of procedure.

Rolland J. Hamilton, president of the American Radiator Company, and vice-president and trustee of the John B. Pierce Foundation, industrial adviser on the code for the cast-iron boiler and radiator industry; also a member of the governing council of the National Association for Better Housing, which is carrying out a unified nationwide policy on this phase of construction.

Additions to Butler Manufacturing Staff

Butler Manufacturing Co., Kansas City, Mo., has appointed A. O. Dady, formerly consulting engineer in Chicago, to the engineering staff of its stoker division. Mr. Dady has been associated with the Delta Stoker Company as president and chief engineer, prior to which he was chief engineer of the Iron Fireman Manufacturing Company.

A. F. Collins, Decatur, Ill., has been appointed stoker salesman for the company in Kentucky and Tennessee.

M. I. T. Plans Domestic Heating Course

Arrangements have been completed with the Massachusetts State Department of Education by James Williamson, manager of the Anthracite Institute's New England branch,

for a series of lectures on domestic heating to be given as a University Extension Course at the Massachusetts Institute of Technology, Cambridge. The course, which will commence early in January under the direction of the Institute's faculty, will cover heating engineering, stokers, and practical domestic heating service, and is expected to be particularly helpful to dealers, salesmen, service men, and those who intend to enter the domestic engineering field.

Preferred Utilities Represents Mineral Felt

The Mineral Felt Insulating Co., 2288 Albion St., Toledo, Ohio, has appointed The Preferred Utilities Corporation, New York, as its representative in Greater New York and Albany.

Fan Association Opens Office

The National Association of Fan Manufacturers has opened an office at 5-208 General Motors Building, Detroit, for the purpose of coordinating activities in this field under the National Recovery Act. The major portion of the fan and blower industry is represented in the association, which has been in existence continuously since 1918.

L. O. Monroe, identified with the industry since 1911, is in charge of the office.

Kroeschell Manufactures at Racine

Kroeschell Boiler Co., Chicago, has leased the plant of Freeman Manufacturing Co., Racine, Wis., in which to carry out all boiler manufacturing activities. The general office at 3253 North Kedzie Ave., Chicago, will be maintained.

Full Schedule for A. S. R. E. Convention

A technical program that excels in variety and significance has been prepared for the 29th annual meeting of the American Society of Refrigerating Engineers, New York, December 6-8. The Hotel New Yorker will be the scene of activities. The program, a considerable portion of which is of direct interest to air conditioning engineers, follows in part:

News of the Month

December 6

10:30 a.m.—"New Applications," A. W. Oakley, chairman.

Applications fo Vacuum Systems, by F. D. Berkeley, Ross Heater and Manufacturing Company.

Coordination of Research and Engineering with Production and Sales. by J. S. Beamensderfer, York Ice Machinery Corporation.

2:30 p.m.—"Thermal Problems," H. Harrison, chairman.

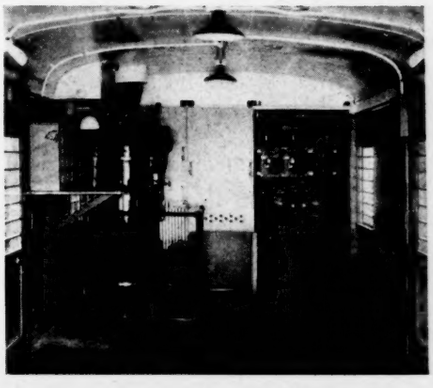
December 7

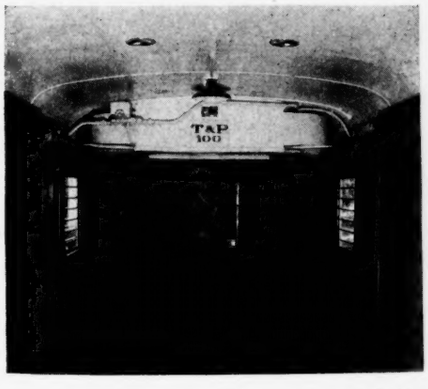
10 a.m.—"Domestic-Commercial Practice," A. R. Stevenson, Jr., chairman.

The Mercury Compressor; New Designs, by J. C. DeRemer and G. W. Dunham, New York.

2 p.m.—"Air Conditioning," Clyde R. Place, chairman.

Psychrometric Investigations and Data, by F. G. Keyes, Massachusetts Institute of Technology.





T. & P. OPERATES 75 M.P.H. AIR-CONDITIONED TRAIN

The new two-car, stainless steel, gas-electric, rubber-tired, air-conditioned train (upper left) built by the Edward G. Budd Manufacturing Co., Philadelphia, for the Texas and Pacific Railway, and placed in service early in November. The heating boiler and switchboard are shown in the forward end of the baggage compartment (upper right). Lower left photo looks toward the rear of baggage compartment and shows ducts for air conditioning and heating. The comfortable interior of the passenger car, looking toward the rear observation compartment, is shown at the lower right. Warm and cold-air ducts can be seen overhead.

News of the Month

Physiological Side of Air Conditioning, by R. R. Sayres, U. S. Public Health Service, Washington, D. C.
Noise Elimination and Air Motion, by C. B. Graves, Campbell Metal Window Corporation.

December 8

10 a.m.—"Air Conditioning," George B. Bright, chairman.
Methods of Passenger Car Cooling, by F. L. Sahlman, General Electric Company.
Unit Equipment for Restaurants, Offices, and Stores, by W. C. Goodwin, Westinghouse Electric and Manufacturing Company.
Air Conditioning Operation in a Rayon Plant, W. C. Giles, The Viscose Company.

Unique Sales Arrangement

A sales plan, whereby winter air conditioning equipment is installed immediately, with arrangements for installation of compressor and cooling coils at the beginning of next summer, the purchaser to pay one-half the cost of the complete air conditioning equipment at each time, has been announced by Campbell Metal Window Corp., 100 East 42nd St., New York.

A. B. C. Forms Accessory Department

A new appliance accessory department to assume charge of the company's business in multi-blade wheels for oil burners, dryers, air conditioning units, etc., has been announced by the American Blower Corp., Detroit, through H. E. Barth, sales manager.

Steamfitters Awarded Beer Piping Work in Chicago

Word has been received from the Chicago Master Steam Fitters' Association concerning a recent decision in the case of a dispute between sheet metal workers and steamfitters over the erection of beer copper piping. Under date of August 10, 1933, the Joint Conference Board of the Building Construction Employers' Association in Chicago rendered the following decision:

"The erection of beer coolers, and the installation of copper pipe or tubing shall be the work of the steamfitters and the installation and erection of all sheet copper for tanks, vats, and other appurtenances shall be the work of the Sheet Metal Workers of Local No. 73."

Warm Air Furnace Men to Meet in Ohio

A full program of timely and instructive discussions will be brought before the members of the National Warm Air Heating and Air Conditioning Association when it meets for its annual convention in Cincinnati, December 5-6. The Netherland-Plaza Hotel has been selected as headquarters. Monday, December 4, will be devoted to meetings of the Board of Directors and the various committees, and the remainder of the program is briefly as follows:

December 5

10 a.m.—Call to order.
President's Address, W. L. McGrath.
Present Government Activities and Business, by Representative to Congress Arthur P. Lamneck.
Our Industry and the N.R.A., by H. T. Richardson.
The Cans and Can'ts of Air Conditioning, by Dana W. Norris.
Report of the Committee on Installation Codes, Prof. J. D. Hoffman, chairman.
2 p.m.—Manufacturers' meeting. (Attendance confined to manufacturers).

December 6

10 a.m.—Research Session.
Report of the Research Advisory Committee, by F. G. Sedgwick, chairman.
Introductory Remarks, by Prof. Arthur C. Willard.
Factors Affecting Human Comfort in Heating and Ventilating, by Prof. Alonzo P. Kratz.
Summer Cooling Studies in the Research Residence During 1933, by S. Konzo, special research associate.
2 p.m.—Conditions in Our Industry, by Arthur F. Frazee.
Air Conditioning as a Factor in National Recovery, by Frank C. Lyons.
Reports of Board of Directors, Committees, and Managing Director.
Election of Officers.

25 Years Ago in

The Heating Ventilating Magazine

DECEMBER, 1908

REVERSED RFFRIGERATION as proposed by Lord Kelvin is described in an article by W. S. Hadaway, Jr., entitled "Electric Heating."

G. M. DAVIS, of the G. M. Davis Regulator Co., Chicago, died in Texas. He was in his 63rd year.

BOYNTON FURNACE CO., New York, has been incorporated with a capital stock of $400,000. Incorporators: Wells S. Dickinson, Charles M. Benedict, and Henry H. Abbott.

PEERLESS HEATER CO., Pittsburgh, Pa., capital, $5000, has been incorporated to manufacture heaters of various kinds. Incorporators: C. Howard Hook, president, Karl E. Nelson, and M. C. Manion. Mr. Hook was formerly interested in the Reliance Heater and Supply Company.

ARTHUR C. WALWORTH, of the Walworth Mfg. Co., Boston, gave a dinner November 18 at the Exchange Club to celebrate the 100th anniversary of his father, James J. Walworth, one of the first men to engage in the pipe and steamfitting business in this country.

NOMINATED FOR PRESIDENT of the American Society of Heating and Ventilating Engineers were James D. Hoffman, Lafayette, Ind., and William G. Snow, Boston.

A PAPER, "The Use of Ice for Cooling Dwelling Places," was presented at the International Congress of Refrigerating Industries by Karl Heimpel, Vienna, Austria.

THE EDITOR OBSERVES that with the advent of the vacuum sweeper, the air washer, and other recently introduced devices for the mechanical equipment of buildings, the necessity has arisen for giving some one besides the architect supervision of the work as a whole in order to avoid the danger of confusion and interference between the various contractors, as well as to enable the different mechanical systems to be installed according to the plans and specifications.

Kingsbury Directs Peerless A. C. Sales

Peerless Electric Co., Warren, Ohio, announces organization of a separate sales and engineering department for all air-handling equipment, including exhaust fans, ventilating blowers, and air conditioning units. The department is under the direction of W. S. Kingsbury. Motor business will be handled as heretofore by the Motor Sales Division.

Low-Cost Housing Funds Allocated

Cincinnati's first large-scale housing project, to be financed by Public Works Administration funds, has been approved by Public Works Administrator Ickes. The project, which will consist of three- and four-story fireproof apartment buildings, containing a total of 2120 rooms,

Twenty-nine of these traveling displays are demonstrating the Arcola hot water heating plant for small homes and buildings in outlying districts of the country. In the view above, Mayor William H. Hopkins, (second from the left) Mayor of Easton, Md., inspects the trailer demonstrater upon its arrival in town.

is estimated to cost $2,380,000 by Tietig & Lee, Cincinnati, architects. Rents will average $9 per room per month.

A loan of $1,333,000 for a similar project for Chicago has been approved by the Administration. Plans call for 420 apartments to rent at an average of $9.50 per room per month.

Walsh New Timken Vice-President

E. V. Walsh, general sales manager of Timken Silent Automatic Corp., Detroit, has been elected vice-president in charge of sales and advertising.

Describes 23-Year Weather Cycle

Evidence that general meteorological conditions all over the world repeat themselves substantially every 23 years was advanced by Dr. Charles G. Abbott, secretary of the Smithsonian Institution, speaking before the National Academy of Sciences, November 20, at Cambridge, Mass.

According to Doctor Abbott, the weather in 1956 will have the same general character as that experienced all over the world in 1933, and the summer of 1934 will show the same general pattern as that experienced in 1911, differing, of course, as to day-by-day details. It is expected that the discovery will prove of great value in forecasting.

That this tendency will be valuable in estimating heating requirements for the future is not borne out by an examination of the records of average yearly temperatures of one large eastern city, extending back to 1871. There is no indication that the degree-day figures for a given year will compare with those for the 23rd year preceding.

COMING EVENTS

DECEMBER 4-8, 1933. Fifty-Fourth Annual Meeting of the American Society of Mechanical Engineers, to be held in New York. Headquarters at 29 West 39th Street.

DECEMBER 5-6, 1933. Convention of the National Warm Air Heating & Air Conditioning Association, to be held in Cincinnati, Ohio. Headquarters at the Netherland Plaza Hotel.

DECEMBER 6-8. 1933. Twenty-Ninth Annual Meeting of the American Society of Refrigerating Engineers, to be held in New York. Headquarters at the Hotel New Yorker.

FEBRUARY 5-8, 1934. Fortieth Annual Meeting of the American Society of Heating and Ventilating Engineers, to be held in New York. Headquarters at the Hotel Biltmore.

FEBRUARY 5-9, 1934. Third International Heating and Ventilating Exposition, to be held in the Grand Central Palace, New York.

MARCH 5-9, 1934. Eleventh Annual Convention and Show of the American Oil Burner Association, to be held in Philadelphia. Exhibition and Convention Hall of the Commercial Museum to be the show site; Hotel Benjamin Franklin to be hotel headquarters.

Inland Steel Makes Appointments

Inland Steel Co., Chicago, is now being exclusively represented on the Pacific Coast by A. M. Castle & Co., Chicago, through the latter company's Los Angeles, San Francisco, and Seattle offices.

Fred E. Bynum, Oklahoma City, is now affiliated with Inland's St. Louis office, selling that company's products in Oklahoma and Arkansas.

Anthracite Laboratory Lists Approved Equipment

The Anthracite Institute Laboratory, Primos, Pa., has issued Bulletin 10-A, replacing Bulletin 10, in which equipment investigated and found satisfactory for use with Pennsylvania anthracite is listed and described. The list includes nine automatic stokers, three magazine boilers, nine thermostatic controls, seven service water heating systems, four vacuum furnace cleaners, seven draft blowers, two space heaters, and several items for testing, draft regulation, and automatic control.

Christian F. Bachler

Christian F. Bachler, senior member and founder of C. F. Bachler & Son, Philadelphia, heating engineers and contractors, died November 5 after one week's illness. He was in his 78th year.

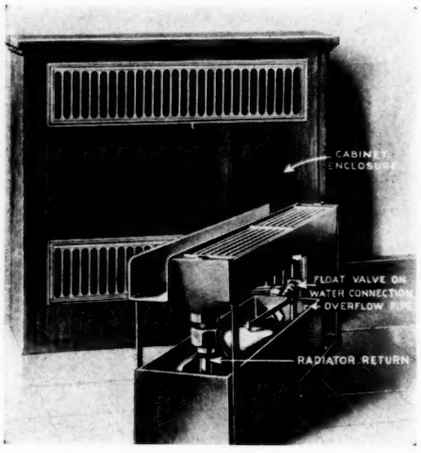
Mr. Bachler, for the past 42 years associated with the heating industry, was one of the founders of the old Monitor Steam Generator Manufacturing Company. He also invented the Monitor U-water tube steel boiler.

Mr. Bachler is survived by two daughters and two sons.

New Equipment

Chase Markets Humidifying Radiator

A humidifying radiator unit, the Thermoist, has been placed on the market by Chase Brass & Copper Co., Inc., Waterbury, Conn.



Thermoist unit and enclosure

Water, contained in the rectangular reservoir beneath the heating element, is warmed and vaporized by heat from the radiator steam connection pipe, which is submerged in it. This water vapor is picked up by the air as it passes upward through the radiator, which is narrow and set back in the cabinet to insure mixture with the vapor.

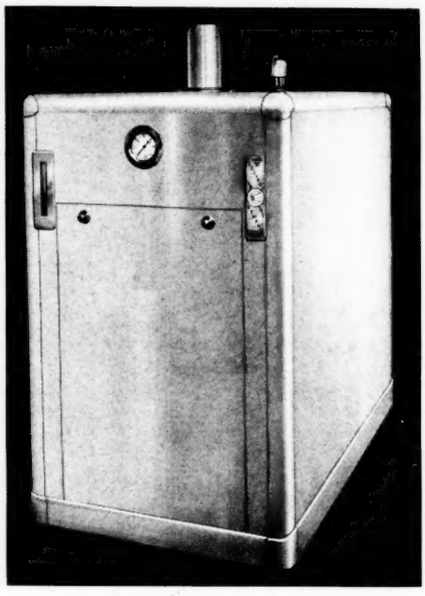
A ¼-in. copper tube, 25 ft. of which are supplied with each unit, connects the reservoir with the water supply, and a float-operated valve maintains the water in the tank at the proper level. The tank is provided with a ½-in. drain pipe connection, through which overflow can be carried from the unit in case the float valve should fail to close.

Electrol-Kewanee Boiler-Burner

Electrol Incorporated, 227 East 45th St., New York, is marketing the Electrol-Kewanee heating unit, a coordinated boiler-burner combination of unusual design, equipped with a built-in domestic water heater. It is available for both steam and hot water systems, and is made in three sizes with rated outputs of 750, 1250, and 1750 sq. ft. of equivalent direct steam radiator surface.

Boiler is mounted horizontally, and consists of three shells of copper-bearing steel, of welded fabrication. The inner shell forms the combustion chamber and is lined with a high temperature refractory material. The space between the inner and the intermediate shell is traversed by 59 seamless steel fire tubes, welded into tube sheets at each end. A water space surrounds the tube section. The manufacturer states that this design promotes extremely rapid steaming with a rapid circulation of the water.

Burner mechanism is located beneath the boiler, and the burner head projects horizontally into the central combustion chamber. Air for combustion is drawn with a rotary motion into the combustion chamber by a fan located at the chimney connection, supplying induced draft through the boiler.



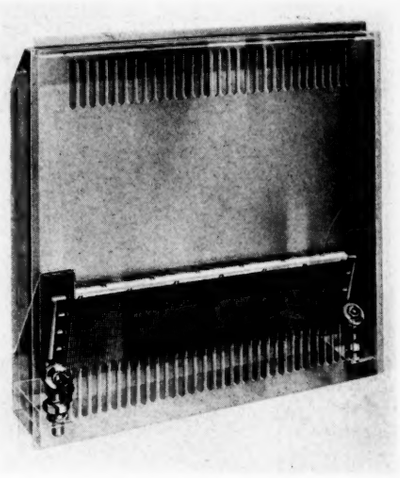
Electrol-Kewanee unit

The complete unit is enclosed in a heat- and acoustically-insulated casing. Operation is completely automatic.

Webster System Radiation

Webster System Radiation, consisting of light-weight, concealed convection units, has been announced by Warren Webster & Co., Camden, N. J. Units are available in a wide range of sizes and capacities.

Heating element consists of copper tubing fitted with aluminum fins, mounted at an inclined angle, a feature claimed by the manufacturer to provide a maximum of heat output for the amount of space occupied. An orificed radiator supply valve and union connection is built



Phantom view, Webster System Radiation

integrally into one header, and a thermostatic return trap and union connection is an integral part of the opposite header. Installation costs are said to be materially reduced as a result of this simplification of piping connections.

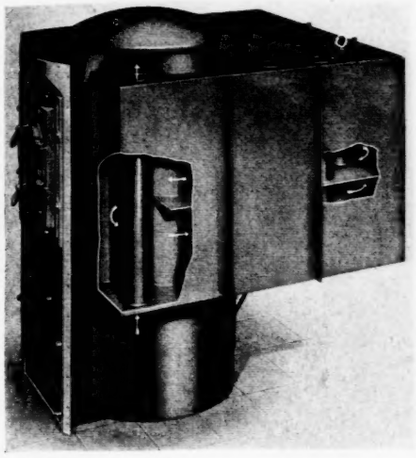
Enclosures are included with this heating surface, and are obtainable with choice of plaster, metal or tile fronts and in cabinet units. All enclosures are so designed as to permit withdrawal of the entire heating element through the lower grille or opening after installation. The manufacturer will supply a catalog containing complete descriptions, dimensions, ratings, and suggested specifications upon request.

Waterbury Oil-Burning Furnace

A series of oil-burning furnaces of seamless welded construction for warm-air heating, is being marketed by The Waterman-Waterbury Co., Minneapolis, Minn. These furnaces are available in four sizes, ranging in capacity from 99,224 B.t.u. to 178,666 B.t.u. per hr. at the registers, when used in gravity systems, or

142,763 B.t.u. to 285,525 B.t.u. with forced circulation. A compact assembly consisting of separate fan, filter, and washer units, assembled vertically, can be conveniently attached to provide complete winter air conditioning functions.

Furnace is provided with large combustion space and an unusually large amount of heating surface. After leaving the combustion chamber, the hot gases make two passes through the baffled radiator at the rear, traversed by warm-air tubes. An adjustable baffle at the back permits bypassing of the flue gases directly to the chimney during the starting-up period. No cast-iron or cemented joints are used in the construction, removing any possibility of dust, soot, or oil fumes entering the warm-air ducts. The bottom of the furnace is welded in position and so constructed that oil cannot leak. A humidifier is mounted on top of the combustion chamber.



Seamless oil-burning furnace

The manufacturer has recently issued a catalog illustrating and describing its complete line of warm-air heating and air conditioning equipment.

Markets Industrial Humidifier

Southworth Machine Co., Portland, Me., is manufacturing the Type C humidifier for industrial and process applications.

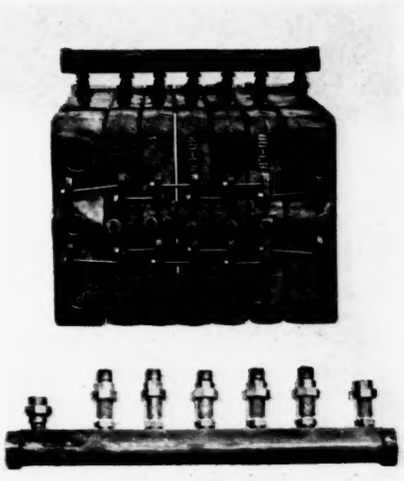
Moisture is added to the air in a vapor produced by projecting water with great force against teeth on a stationary circular grid. A propeller-type fan circulates the air. The device is driven by a 1/5-hp. motor, and operation of each unit is regulated individually by a self-contained automatic control, which is said by the manufacturer to operate within 2 min. of a change of 2% in relative humidity.

Burnham Flexible Header

Burnham flexible headers for circulating hot water from all the sections of the heating plant boiler to the indirect water heater, have been announced by Burnham Boiler Corporation, Irvington, N. Y.

Header is connected to the boiler sections by flexible bellows fittings on nickel silver with brass connections. This bellows arrangement permits a movement of the connection in any direction of ¼ in. from the center, eliminating the assembling difficulties often encountered as a result of off-center or crooked tappings. The manufacturer states that this feature reduces installation costs, and that the one-piece construction of the header cuts the friction to a minimum.

Headers are 2 in. in diameter and are available in 25 in., 32 in., and 42 in. lengths. The flexible connectors are 1 in. in diameter, with 1 in. brass unions.



Header installed on boiler, above, and detail of header, below

Human Hair Controls Humidity

A high degree of sensitivity and accuracy is claimed by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., for its new line of humidity controls, suitable for residential and small commercial installations.

Hygroscopic actuating element consists of multiple groups of human hair, operating a mercury tube switch through a simple lever mechanism. Ample electrical capacity is provided for direct control of line voltage solenoid valves or small motors, and with other circuit arrangements motorized valves may be operated. When the device is used as a pilot control for a magnetic starter, larger loads may be handled, limited only by the load rating of the starter.

Open and closed views of Minneapolis-Moneywell humidity control

Models are available having relative humidity indicators built into the covers. The setting pointer is internal, and inaccessible without the key to the cover locking device. The control can be set for any relative humidity between 20% and 80%, and the operating differential is given as 2%.

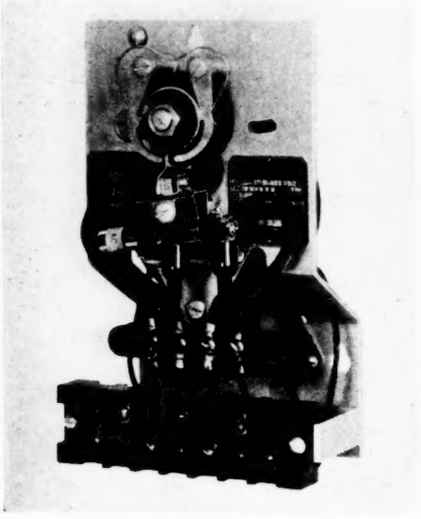
Stoker Control Anticipates Demand

Automatic control of heating plant stokers to maintain even combustion at a rate exactly sufficient to compensate for heat losses, and to guard against failure of the fire in mild weather, are functions of the Multispeed stoker control, recently-announced development of The Leland Electric Co., Dayton, Ohio. This control regulates both

the period between firings and the duration of the firing period, in accordance with the demands of any 3-wire low voltage thermostat.

When the rooms are above temperature, with the thermostat on the upper limit or hot contact, the control functions to operate the stoker for approximately 1 min. every 50 or 60 min., depending upon the speed adjustment. When rooms are at the desired temperature, with neither contact in the thermostat closed, the control operates at a speed to fire the stoker once every 20 to 25 min., for a period of approximately 1 min. When the lower limit contact on the thermostat is closed, the control immediately starts and continues the firing until the thermostat is satisfied, when it will again resume its intermittent timing cycle. By increasing the minimum rate of firing from three to four times when the thermostat opens the upper limit contact, the control anticipates a demand for heat.

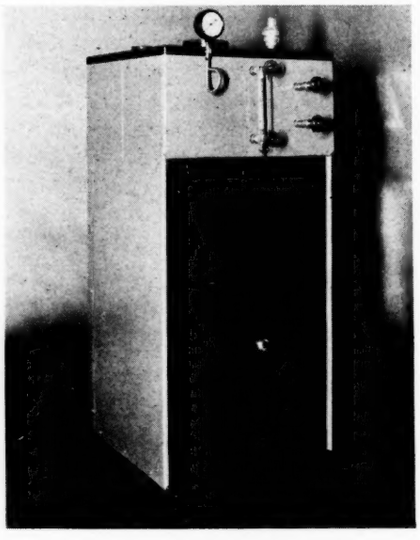
The device is operated through its cycle of firing and stand-by positions by a small ball-bearing motor, drawing a maximum of eight watts. The stoker motor is started and stopped by a Kontax mercury-to-mercury switch, product of Leland, said to be good for indefinite cycles of operation without deterioration. Switching operations incidental to the multispeed control operation are accomplished in a second and smaller mercury tube arranged for double-throw operation. Exposed steel parts are cadmium-plated to resist corrosion, and the complete system is assembled in a knock-out box. No relays or transformers are required as connections to the thermostat are made to shading coils in which the maximum induced potential does not exceed two volts.



Multispeed control

Water Tube Boiler for Oil Heating

Fletcher Engineering Co., Inc., 75 Westminster St., Providence, R. I., is distributing the Almy Type W oil-burning boiler unit for residential and small commercial heating plants, product of the Almy Water Tube Boiler Co., Providence. The



Almy oil-burning boiler

boiler is available in two sizes, for both steam and hot water, having capacities of 450 sq. ft. and 900 sq. ft. equivalent direct steam radiator surface. It is designed for sale as a boiler-burner unit by oil burner dealers.

Boiler is of the fountain type, with the generated steam delivered above the water line, and is said by the manufacturer to be remarkably quick-steaming. Tubes in the rear of the boiler carry the downflow into a water base, maintaining continuous circulation in one direction. The combustion space is entirely surrounded by heat absorbing surface, and the smoke flue is carried through the steam space, utilizing the flue gases to heat the water and dry the steam.

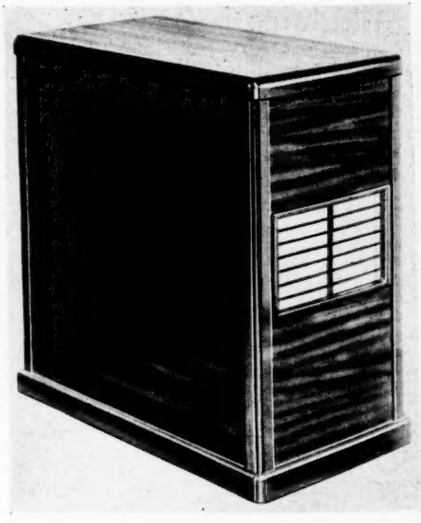
Tubes are of seamless formation, of 3/16 in. steel, and ¼ in. steel plate is used in the steam dome and water base. The boiler is enclosed in an insulating jacket, consisting of asbestos felt protected on both sides by bolted steel sheets. A built-in heater supplies domestic hot water.

Campbell Humidifier and Air Washer

Campbell Metal Window Corp., Air Conditioning Div., 100 East 42nd St., New York, has recently introduced a portable floor model humidifier and air washer for residential and office installation. This equipment requires connection to electrical outlet only.

A paddle wheel, consisting of six fabric blades supported on a metal frame, is suspended in a water tank housed in the lower section of the metal cabinet. A motor-driven fan, mounted directly behind the paddle, draws room air into the enclosure at the floor level and passes it through the saturated blades of the wheel, washing dust and dirt from the air and adding moisture to it for humidification. The collected dust and impurities are washed off the blades as the wheel rotates through the water.

Water is supplied to the tank from a reservoir of 10-gal. capacity, housed in the upper part of the cabinet, and its flow to the lower tank is regulated by a float-operated needle valve. An automatic control stops the fan when the water supply is exhausted.



Floor model humidifier and washer

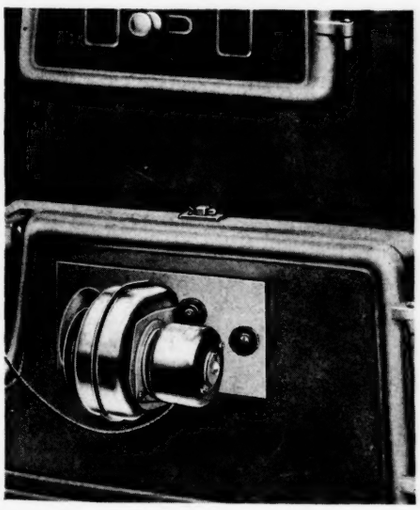
A table model, similar in operating principle, is also offered. This unit requires a small electric desk fan, placed on the table behind it, to circulate the air and revolve the paddle. Both models evaporate water into the air at a rate of 1 pt. per hr., and have an air washing capacity of 12,000 cu. ft. per hr.

Worthington Announces Compact Compressor

Worthington Pump and Machinery Corp., Harrison, N. J., has introduced a line of equipment known as Uni-bloc diesel and gas engine refrigeration compressors. In these units a compressor cylinder is mounted directly on the base of a standard Worthington vertical four-cycle engine, and the piston of one power cylinder is replaced by a cross-head connected by a connecting rod to the compressor cylinder, directly above. In addition to compactness, the manufacturer claims that high efficiencies are achieved with this equipment due to the reduction of mechanical friction, the use of feather valves adapted for high speeds, and the location of the suction valve in the top of the cylinder.

Perfecto Buckwheat Blower

F. A. Smith Manufacturing Co., Inc., Rochester, N. Y., is marketing the Perfecto automatically-controlled coal burner, a forced-draft blower for burning buckwheat anthracite in residential and other small heating plants.

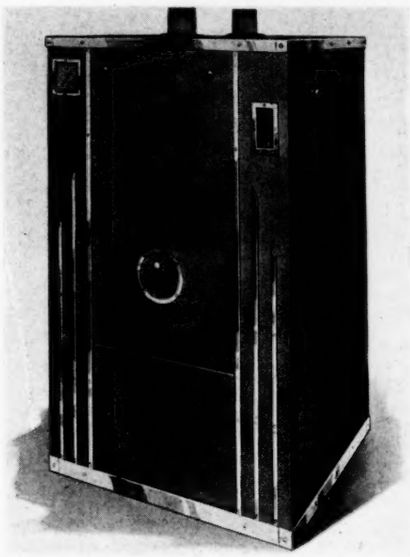


Perfecto buckwheat burner

Unit is attached to a mounting plate which is clamped on the boiler or furnace to replace the ashpit door. A shaded pole induction motor drives the blower which is of the Sirocco fan type, carefully balanced and running in heavy bearings. Operation is controlled by a wall-type room thermostat, furnished as standard equipment, and the blower can also be used in conjunction with other limiting controls. Models are available for use with 110-volt thermostat, or for operation on 20-volt power, with a transformer in series with the motor.

Thatcher Announces OilMaster Boiler

Designed exclusively for oil firing, the OilMaster boiler is a recent addition to the line of products manufactured by The Thatcher Co., 39-41 St. Francis St., Newark, N. J. It is available in four sizes in each of two series of models for both steam and hot water heating. Capacities range from 450 sq. ft. to 940 sq. ft. of equivalent direct steam radiating surface.



OilMaster 36-Series

Boilers are of the rectangular cast-iron sectional type, enclosed in an insulated sheet-iron casing. A large combustion chamber and unusually long five-pass fire travel have been provided for efficient absorption of heat from the oil flame. When desired, an internal domestic water heater can be installed in the 5-in. nipple openings connecting the tops of the boiler sections.

New Equipment

The 36-Series OilMaster is enclosed within 8-ply insulation, 2 in. thick. No trimmings protrude from the boiler, all gauges, try-cocks, etc., being built into the casing. The 26-Series, similar in construction and capacities to the Series 36, is enclosed in a less elaborate jacket, lined with 4-ply asbestos insulation.

Dailaire Coal Furnaces Improved

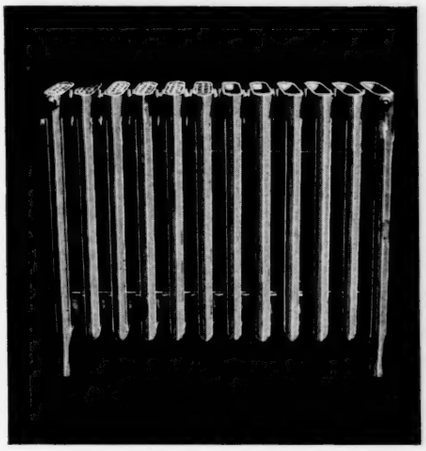
Dail Steel Products Co., Lansing, Mich., has announced an improved line of Dailaire coal-burning warm-air residential heating furnaces.

Series 200, built in two sizes, capacities 141,960 B.t.u. and 218,400 B.t.u. per hr., incorporates a wedge-shaped combustion dome with flues on each side, providing increased radiating surface. Radiators are assembled to the combustion chamber by four large telescoping tubes, closely machined and wound with asbestos rope and cemented. Welded construction is used throughout.

Series 100, having an output of 106,298 B.t.u. per hr., is built with a low, square combustion chamber, to meet the requirement where the basement ceiling is low. A large and deep radiator, baffled to keep heat travel in close contact with the heating surface, is located at the rear.

Humidifying Radiator

Utica Radiator Corp., Utica, N. Y., is manufacturing the Humid-Heet cast-iron humidifying radiator for



Humid-Heet radiator

residential steam or hot water heating.

Each section has a large water chamber at its top, covered with a removable porcelain enameled grille. Water is supplied to the humidifier through a pipe connection, and is conveyed to all the sections through nipple connections. Excess water is drained from the last section. The grille and water chambers are finished in cream enamel, and the entire radiator is furnished with the outside primed for painting.

Humid-Heet radiators are available in four, five, and six-tube styles in heights of 21½ in., 24½ in., and 33½ in. The manufacturer states that ample humidity will be supplied if these humidifying radiators are substituted for 15% of the radiating surface in a residence.

American Bosch Markets Humidifier

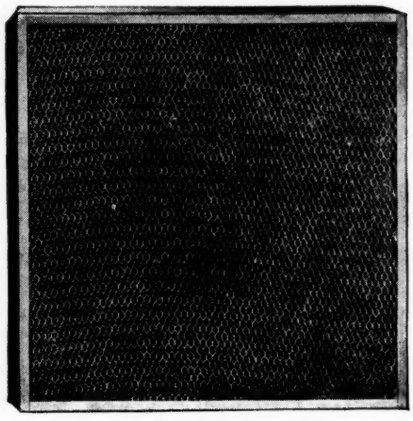
United American Bosch Corp., Springfield, Mass., is marketing the American Bosch humidifier for residential and office installation. This apparatus is available in fully-automatic, semi-automatic, and manually-controlled models, the operating principle and cabinet design being the same for all three types.

A 70-watt, universal current type motor rotates a conical copper tube at approximately 6000 r.p.m. This tube extends down into the water reservoir, and the water is drawn up through the tube and delivered to a metal disc, fixed to the shaft, by centrifugal force. The water is then whirled from the disc and impinged against stationary fins which break it up into an extremely fine mist. A motor-driven fan in the bottom of the cabinet draws room air into the enclosure and passes it upward around the humidifying chamber, discharging it back into the room washed and humidified.

Fully-automatic model is designed for direct connection to the water supply and is equipped with a humidistat which controls the operation of the device to maintain the correct-degree of relative humidity in the room. A float valve in the reservoir admits water as needed. The semi-automatic model is equipped with a humidistat, but has no provision for direct connection to the water supply. The manually-controlled model is started and stopped as comfort dictates by a hand switch.

Viscous-Coated Air Filter

Hold-Heet air filters for gravity and forced-circulation warm-air heating and air conditioning plants, are a recently announced product of Russell Electric Co., 346 West Huron St., Chicago. They are available in three sizes, F1, F2, and F3, respectively, 20 in. by 20 in., 16 in. by 25 in., and 20 in. by 30 in. The first two show a pressure drop of 0.08 in. of water at 800 c.f.m. when clean, and the last has the same resistance at 1200 c.f.m.



Hold Heet air filter

Units consist of an adhesive-coated fibrous filler supported in a welded steel frame with expanded sides. The adhesive coating used was developed to provide an odorless material having a minimum change in viscosity under considerable variation in temperature. The metal frame is rigid and requires no additional frame or bracing, and can be installed supported at the ends only if desired.

1933 INDEX READY!

The annual index for the 12 issues of HEATING AND VENTILATING for 1933 has been prepared and will be mailed on request to any subscriber without cost. Address Subscription Department, HEATING AND VENTILATING, 148 Lafayette St., New York.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF MARCH 3, 1933 OF HEATING AND VENTILATING, published monthly at New York, N. Y., for October 1, 1933.

State of New York, County of New York, ss.:

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the Treasurer of The Industrial Press, publishers of Heating and Ventilating and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, The Industrial Press, 140-148 Lafayette St., New York, N. Y.

Editor, C. H. B. Hotchkiss, 140-148 Lafayette St., New York, N. Y.

Managing Editor, Clifford Strock, 140-148 Lafayette St., New York, N. Y.

Business Managers, Robert B. Luchars, 140-148 Lafayette St., New York, N. Y.; Edgar A. Becker, 140-148 Lafayette St., New York, N. Y.; Erik Oberg, 140-148 Lafayette St., New York, N. Y.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

The Industrial Press, 140-148 Lafayette St., New York, N. Y.; Estate of Alexander Luchars, 140-148 Lafayette St., New York, N. Y.; Louis Pelletier, 140-148 Lafayette St., New York, N. Y.; Erik Oberg, 140-148 Lafayette St., New York, N. Y.; Robert B. Luchars, 140-148 Lafayette St., New York, N. Y.; Edgar A. Becker, 140-148 Lafayette St., New York, N. Y.; Laura A. Brownell, 140-148 Lafayette St., New York, N. Y.; Franklin D. Jones, 140-148 Lafayette St., New York, N. Y.; Elizabeth Y. Urban, 163 Western Drive, Longmeadow, Mass.; Helen L. Ketchum, Atlantic Ave., Cohasset, Mass.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner: and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 22nd day of September, 1933.

CHARLES P. ABEL

Notary Public
Kings County No. 319
Kings Register No. 5120
N. Y. County No. 207
N. Y. Register No. 5-A-128
Commission Expires
March 30, 1935.

October Degree-Days Bring Season's Total Above Normal

	Atlanta	Baltimore	Birmingham	Boston	Buffalo	Chicago	Cincinnati	Cleveland
Degree-days for October, 1933.....	82	230	56	374	451	386	318	361
Degree-days, Sept. 1, 1933 to Oct. 31, 1933.	82	238	56	429	542	425	326	399
Degree-days, Sept. 1, 1932 to Oct. 31, 1932.	147	231	120	346	477	477	342	381
Comparison, season to date with last, %.	— 44	+ 3	— 5	+ 24	+ 14	— 11	— 5	+ 5
Degree-days, Sept. 1 to Oct. 31, Normal.	96	223	—	411	494	356	248	393
Comparison, season to date with nor'l, %.	— 15	+ 7	∞	+ 4	+ 10	+ 19	+ 31	+ 2
Lb. coal per sq. ft. rad., October, 1933...	0.656	1.840	0.448	2.992	3.608	3.088	2 544	2.888
Gal. oil per sq. ft. rad., October, 1933....	0.056	0.158	0.038	0.256	0.309	0.265	0.218	0.248
Cu. ft. gas per. sq. ft. rad., October, 1933.	7.87	22.08	5.38	35.90	43.30	37.06	30.53	34.66

	Davenport	Dayton	Denver	Des Moines	Detroit	Duluth	Fort Wayne	Grand Rapids
Degree-days for October, 1933.....	399	406	235	438	398	751	435	468
Degree-days, Sept. 1, 1933 to Oct. 31, 1933.	432	427	285	485	461	921	485	532
Degree-days, Sept. 1, 1932 to Oct. 31, 1932.	504	377	605	550	459	988	482	536
Comparison, season to date with last, %.	— 14	+ 13	— 53	— 12	Same	— 7	Same	Same
Degree-days, Sept. 1 to Oct. 31, Normal.	363	273	500	357	442	881	347	476
Comparison, season to date with nor'l, %.	+ 19	+ 20	— 43	+ 36	+ 4	+ 5	+ 40	+ 12
Lb. coal per sq. ft. rad., October, 1933...	3.192	3.248	1.880	3.504	3.184	6.008	3.480	3.744
Gal. oil per sq. ft. rad., October, 1933....	0.274	0.278	0.161	0.300	0.273	0 515	0.298	0.321
Cu. ft. gas per. sq. ft. rad., October, 1933.	38.30	38.98	22.56	42.05	38.21	72.10	41.76	44.93

	Harrisburg	Hartford	Indianapolis	Kansas City	La Crosse	Los Angeles	Louisville	Memphis
Degree-days for October, 1933.....	354	389	349	234	528	55	242	111
Degree-days, Sept. 1, 1933 to Oct. 31, 1933.	395	459	356	247	614	90	243	111
Degree-days, Sept. 1, 1932 to Oct. 31, 1932.	352	405	387	348	753	14	275	150
Comparison, season to date with last, %.	+ 12	+ 13	— 8	— 29	— 18	+ 543	— 12	— 26
Degree-days, Sept. 1 to Oct. 31, Normal.	329	392	298	214	558	—	186	62
Comparison, season to date with nor'l, %.	+ 20	+ 17	+ 19	+ 15	+ 10	∞	+ 31	+ 79
Lb. coal per sq. ft. rad., October, 1933...	2.832	3.112	2.792	1.872	4.224	0.440	1.936	0.888
Gal. oil per sq. ft. rad., October, 1933....	0.243	0.267	0.239	0.160	0.362	0.038	0.166	0.076
Cu. ft. gas per. sq. ft. rad., October, 1933.	33.98	37.34	33.50	22.46	50.69	5.28	23.23	10.66

	Milwaukee	Minneapolis	New Haven	New Orleans	New York	Omaha	Peoria	Philadelphia
Degree-days for October, 1933.....	456	548	355	5	288	351	412	227
Degree-days, Sept. 1, 1933 to Oct. 31, 1933.	499	608	406	5	319	394	433	246
Degree-days, Sept. 1, 1932 to Oct. 31, 1932.	572	717	368	32	292	462	482	218
Comparison, season to date with last, %.	— 13	— 15	+ 10	— 84	+ 9	— 15	— 10	+ 13
Degree-days, Sept. 1 to Oct. 31, Normal.	534	574	399	—	276	329	384	242
Comparison, season to date with nor'l, %.	— 7	+ 6	+ 2	∞	+ 16	+ 20	+ 13	+ 2
Lb. coal per sq. ft. rad., October, 1933...	3.648	4.384	2.840	0.040	2.304	2.808	3.296	1.816
Gal. oil per sq. ft. rad., October, 1933....	0.313	0 376	0.243	0.003	0.197	0.241	0.283	0.156
Cu. ft. gas per. sq. ft. rad., October, 1933.	43.78	52.61	34.08	0.48	27.65	33.70	39.55	21.79

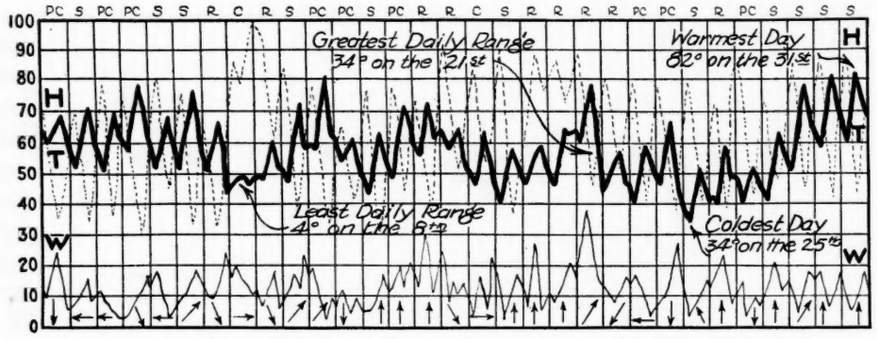
	Pittsburgh	Portland, Ore.	Providence	Reading	Rochester	St. Louis	Salt Lake City	San Francisco
Degree-days for October, 1933.....	347	248	383	314	462	252	197	137
Degree-days, Sept. 1, 1933 to Oct. 31, 1933.	367	415	449	358	558	253	243	259
Degree-days, Sept. 1, 1932 to Oct. 31, 1932.	371	329	389	349	489	277	463	205
Comparison, season to date with last, %.	— 1	+ 26	+ 15	+ 3	+ 14	— 6	— 48	+ 26
Degree-days, Sept. 1 to Oct. 31, Normal.	313	437	410	344	503	205	406	260
Comparison, season to date with nor'l, %.	+ 17	— 5	+ 10	+ 4	+ 11	+ 24	— 40	Same
Lb. coal per sq. ft. rad., October, 1933...	2.776	1.984	3.064	2.512	3.696	2.016	1.576	1.096
Gal. oil per sq. ft. rad., October, 1933....	0.238	0.170	0.263	0.215	0.317	0.173	0.135	0.094
Cu. ft. gas per. sq. ft. rad., October, 1933.	33.31	23.81	36.77	30.14	44.35	24.19	18.91	13.15

	Scranton	Seattle	Spokane	Syracuse	Toledo	Trenton	Washington, D. C.	Wichita
Degree-days for October, 1933.....	440	346	410	469	421	339	275	171
Degree-days, Sept. 1, 1933 to Oct. 31, 1933.	535	568	662	562	472	370	285	180
Degree-days, Sept. 1, 1932 to Oct. 31, 1932.	470	487	638	462	476	317	257	299
Comparison, season to date with last, %.	+ 14	+ 17	+ 12	+ 22	Same	+ 16	+ 11	— 40
Degree-days, Sept. 1 to Oct. 31, Normal.	457	595	707	521	378	242	251	192
Comparison, season to date with nor'l, %.	+ 17	— 5	— 6	+ 8	+ 25	+ 53	+ 14	— 6
Lb. coal per sq. ft. rad., October, 1933...	3.520	2.768	3.280	3.752	3.368	2.712	2.200	1.368
Gal. oil per sq. ft. rad., October, 1933....	0.302	0.237	0.281	0 322	0 289	0.232	0.189	0.117
Cu. ft. gas per. sq. ft. rad., October, 1933.	42.24	33.22	39.36	45.02	40.42	32.54	26.40	16.42

Fuel consumption figures given above are based on certain conditions, and for other conditions corrections must be made. The figures assume the use of steam radiators emitting 240 B.t.u. per sq. ft. per hr., a system operating at 100% efficiency, and radiators calculated for maintaining 70° in zero weather. Heating values assumed for the fuels are 12,000 B.t.u. per lb. for coal, 1000 B.t.u. per cu. ft. for gas, and 140,000 B.t.u. per gal. for oil. To correct for other heating values, efficiencies, and design conditions, follow the method explained in the "Heating and Ventilating Degree-Day Handbook."

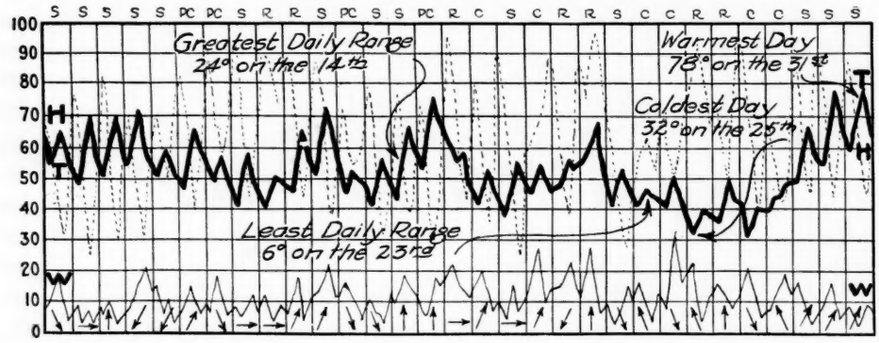
THE WEATHER FOR OCTOBER, 1933

Plotted from records especially compiled for HEATING AND VENTILATING by the U. S. Weather Bureau. Heavy curves (T), temperatures in deg. F.; dotted lines (H), per cent relative humidity, from readings at 8 a.m., noon, and 8 p.m., except for New York, which shows hourly readings. Light lines (W), wind velocity in m.p.h. Arrows indicate prevailing wind directions. S—clear; PC—partly cloudy; C—cloudy; R—rain; Sn—snow.



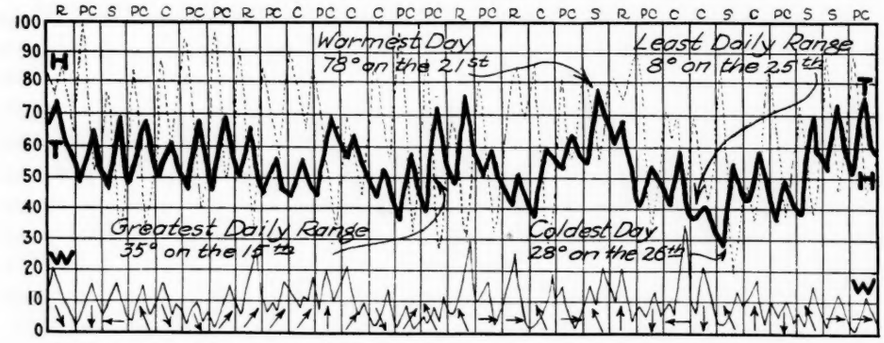
St. Louis

Mean temp. for month, 58.8°; aver. wind velocity, 11.7 m.p.h.; prevailing direction of wind, S.



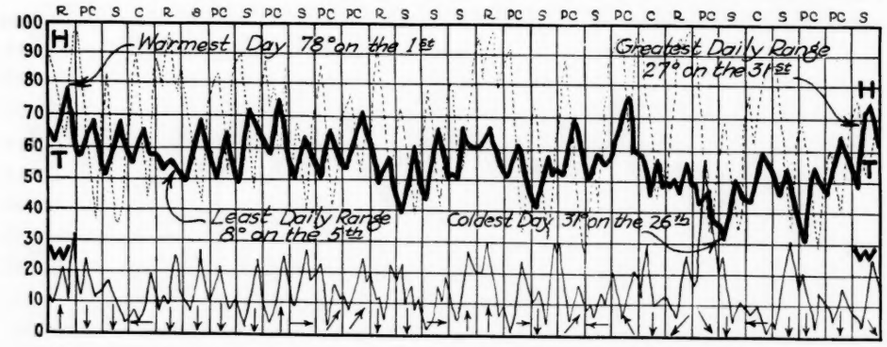
Chicago

Mean temp. for month, 54°; aver. wind velocity, 10.7 m.p.h.; prevailing direction of wind, S.W.



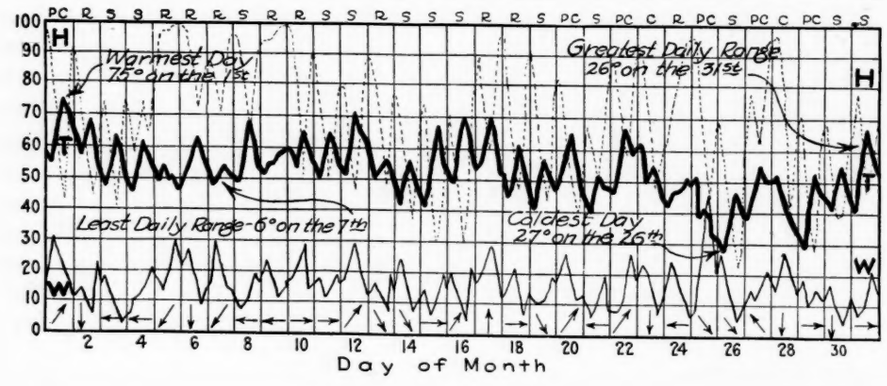
Pittsburgh

Mean temp. for month, 55.6°; aver. wind velocity, 8.7 m.p.h.; prevailing direction of wind, S.W.



New York

Mean temp. for month, 56.3°; aver. wind velocity, 13.0 m.p.h.; prevailing direction of wind, N.


Warmest Day
75° on the 1st
Greatest Daily Range
26° on the 31st
Least Daily Range-6° on the 7th
Coldest Day
27° on the 26th
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

Boston

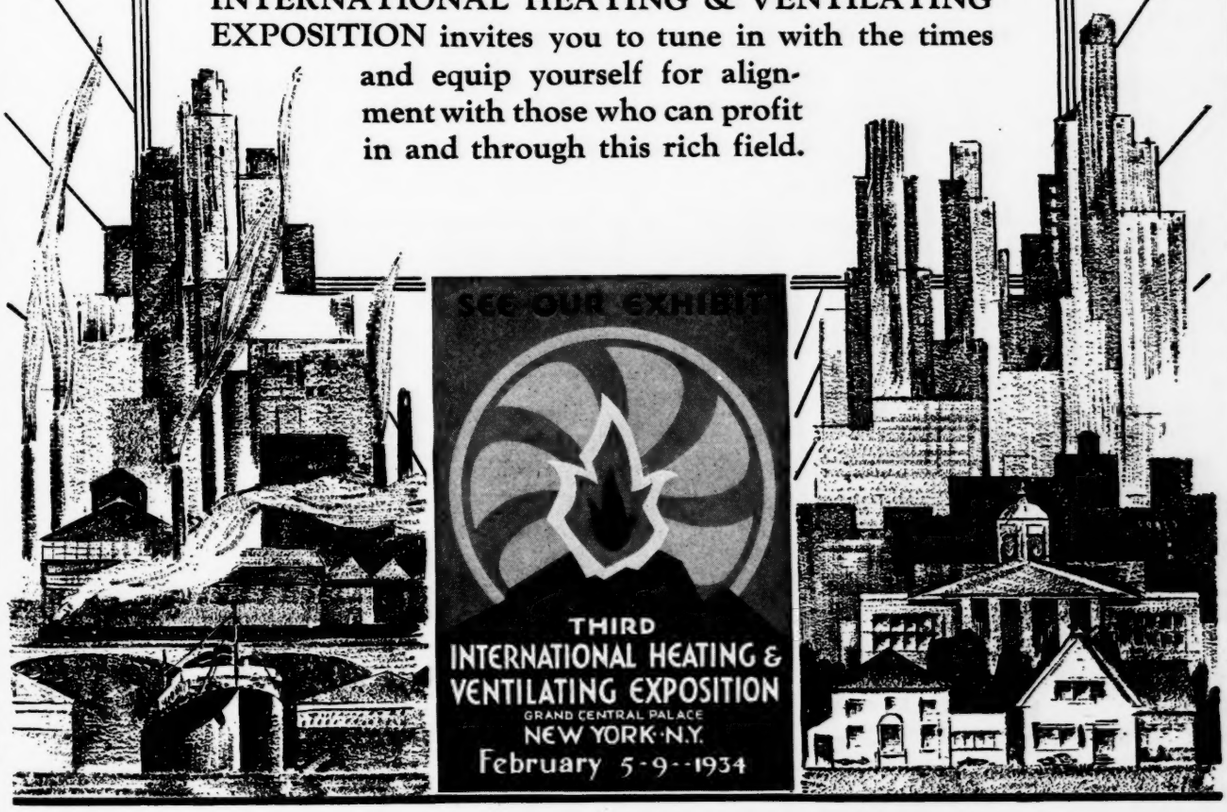
Mean temp. for month, 53.6°; aver. wind velocity, 14.5 m.p.h.; prevailing direction of wind, W.

"HITHERTOS"
are passing out

Throughout industry "hithertos" are dying fast. Precedent, nowadays, is more handicap than help. Above all this is true in the heating, ventilating, air conditioning profession, industry and trade.

Changes during the past two years have been phenomenal. Methods new a year ago are already obsolete. New equipment, appliances, methods, materials, accessories, tools, instruments and supplies are revolutionizing the field and opening unmeasured opportunities for those who keep up to date.

A panorama of progress—an Exposition at which you can view, examine, question and compare — the INTERNATIONAL HEATING & VENTILATING EXPOSITION invites you to tune in with the times and equip yourself for alignment with those who can profit in and through this rich field.



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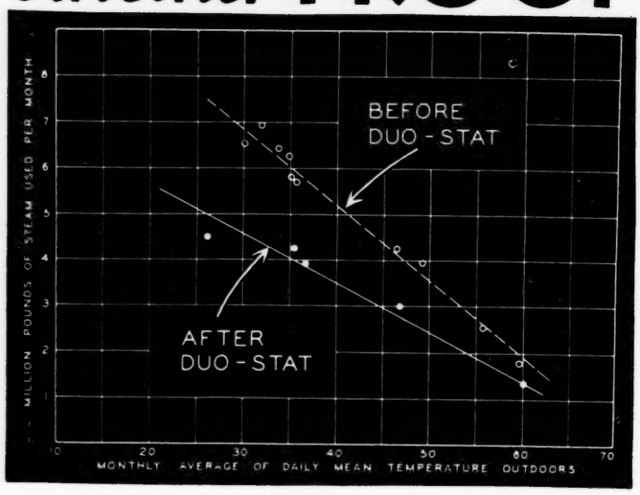
Another PROOF



—*an accurate picture of* DUO-STAT SAVINGS *in the Hearst Building of Chicago*

It was even more than we had hoped for! In exactly six weeks the Raymond Duo-Stat in the Hearst Building, Chicago, had paid for itself. The story of this big cut in steam costs is shown above in the simplest possible way—by simply plotting steam used per month against the daily mean temperature outdoors.

If this were the only record of its kind you would have a right to question it. But the record of the Hearst Building is merely one leaf of a great mass of evidence for the Raymond Duo-Stat. We have charted many of these records in the same way that the Duo-Stat record in the Hearst Building is pictured above. Have you received a set of these charts?

What would the picture of Duo-Stat savings reveal in the building, or buildings, in which you are interested? We will gladly chart this for you if you will simply supply a record of steam or fuel consumption by months for the last year. We have prepared many charts of this kind and the theoretical steam saving that they show has invariably been exceeded by actual performance in those cases where the Duo-Stat was later installed.

F. I. RAYMOND CO.
629 W. Washington Blvd.
CHICAGO, ILL.

The **DUO-STAT** *alone combines these features* ●

- Controls room temperature by a combination of outside and radiator temperature. (A fully protected principle.)
- Is just as effective with one-pipe system as two-pipe system.
- Accomplishes partial filling of radiators in either a one-pipe or two-pipe system.
- Cannot be upset by open windows.
- Gives a modulated control that can only be described as Duo-Stat modulation.

RAYMOND **DUO-STAT**

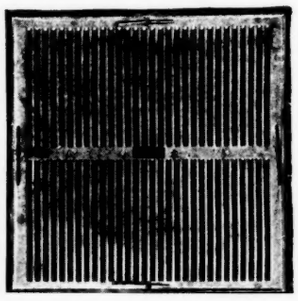
The Nose can't stop Germs and Dust

Tests made by the U. S. Weather Bureau in St. Louis showed 17,600 particles of dust per cu. ft. of air. That means the average person inhales a tablespoon of dust and soot every 24 hours. And that dust often contains germs of typhoid fever, tuberculosis, influenza, etc., is proven by tests made in a Boston Hospital, which showed nearly 450 living bacteria in 10 liters of air.

Prevent dangerous bacteria from spreading disease by installing Protectomotor Panel Air Filters in your buildings. They also prevent dust from ruining products and save building owners thousands of dollars yearly now spent to clean, paint and replace furnishings, etc.

The Protectomotor positively keeps 99-9/10% of the dust and soot out of buildings. No oil drains or cleaning tanks are required.

This filter operates about 2 months without cleaning and can be cleaned in about half a minute per panel with our vacuum cleaner.



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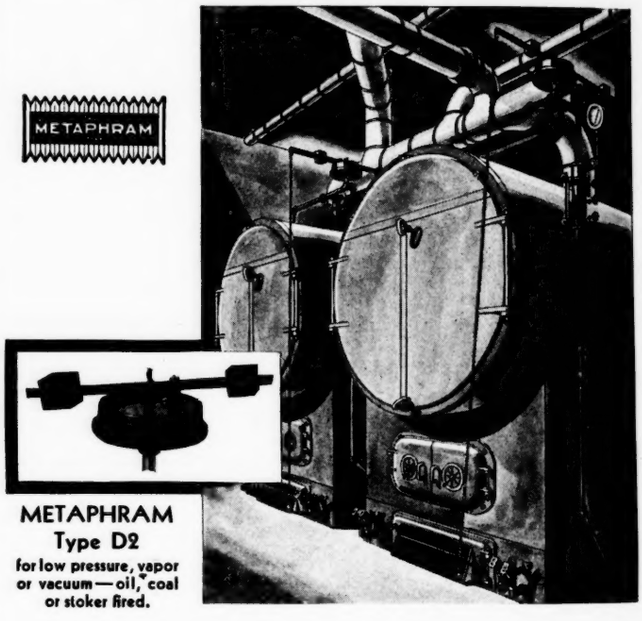
99 9/10 Per Cent EFFICIENT
AIR FILTERS

METAPHRAM



METAPHRAM
Type D2
for low pressure, vapor or vacuum—oil, coal or stoker fired.

METAPHRAM Gradual Control

covers the entire range of domestic hot water and low pressure boilers and tank heaters, either gas, oil or coal fired.

Descriptive Bulletins on Request

NATIONAL REGULATOR CO.
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FULL AREA
gives added safety

Davis Exhaust Relief Valves — condenser safety valves — hold tight under vacuum and relieve to atmosphere at a fraction of a pound pressure giving full and immediate atmospheric relief. Pressure accumulation that might damage costly equipment is prevented. Davis design provides full pipe area not only through the port but through all body passages as well. This feature has influenced many experienced engineers to specify Davis Exhaust Relief Valves for this important service. They get full condenser protection. Hand and hydraulic lift types. Horizontal, vertical and angle patterns.

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H&V12-Gray

MERCOID AUTOMATIC CONTROLS
ARE EQUIPPED *with*
"IT USED THE WORLD OVER" MERCOID CONTROL

CHACE THERMOSTATIC BIMETAL
"It Bends with the Heat"

Since 1928 ››

Thousands upon thousands of Chace Bimetal formed units have been supplied to meet Mercoid's rigid specifications—not one Chace unit has ever been rejected. Accuracy, consistent uniformity and dependable operation under all conditions are the results of strict adherence to known, proven engineering and plant practices. 1200° F. without distortion. Consult our Eng. Dept. regarding your specific problem.

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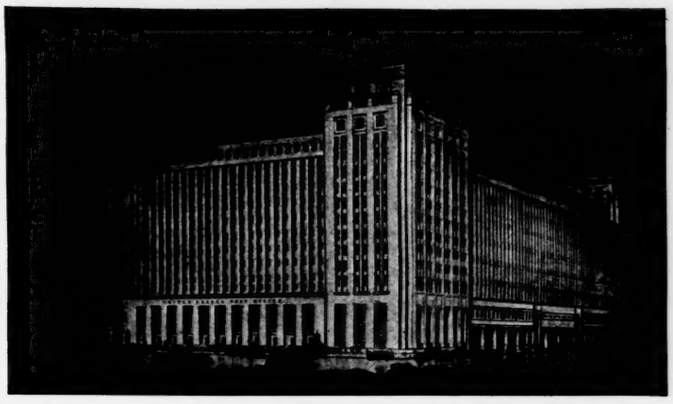
W. M. CHACE VALVE CO.
1606 Beard Avenue . . . Detroit Mich.



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AEROFIN
Fan Blast Heat Surface
Installed Throughout

Universal Aerofin

AEROFIN, the original, modern, scientific Fan System Heat Surface, was chosen by Architects, Graham, Anderson, Probst & White, for Chicago's great new Post Office Building and installed under the general contract of John Griffiths & Son Company by H. P. Reger & Company, heating contractors.

AEROFIN won out again, as in hundreds of installations, because of superior design and workmanship and for its exclusive features.

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List upon Request

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CLASSIFIED ADVERTISING

Wanted: Established Sales Engineers or Manufacturers' Agents with knowledge of Forced Air Heating or Air Conditioning, who can handle definite territory on commission basis, on a well engineered line of equipment, which is showing a record of outstanding performance, and giving real satisfaction to both customer and dealer. Only high grade men with engineering knowledge need apply. Furnish your engineering record and your complete sales experience and references. Box No. 420, care HEATING AND VENTILATING, 148 Lafayette St., New York.

Distributors Wanted: For a full line of Automatic Coal Stokers. The household size installed for less than $250.00—a very fast seller. Prices on larger sizes are competitive. Manufacturer has a triple A1 rating. A real opportunity to make money. Box No. 421, care HEATING AND VENTILATING, 148 Lafayette St., New York.

SALES ENGINEERS—Competent sales engineers wanted to sell established line of furnace fans, blowers and winter air conditioning equipment on commission basis in exclusive territories. Local district representatives are to replace traveling representatives from the home office. Please furnish complete outline of experience and references in first letter. Box No. 423, care HEATING AND VENTILATING, 148 Lafayette St., New York.

WANTED: Manufacturers' Agents or Sales Engineers with forced air heating and air conditioning experience to handle a definite territory on commission basis on line of equipment showing increased sales. Give complete experiences and references in first letter. Box 422, HEATING AND VENTILATING, 148 Lafayette St., New York.

WANTED AIR CONDITIONING SALES ENGINEER Between 25 and 45 years of age, with technical training, for position with large public utility in East. Must have working knowledge of various systems of air conditioning—compressor, absorption, and steam ejector—and to be familiar with equipment now available; including individual units and central plants. Work will comprise sales planning, contacting prospects, analyzing customer requirements and designing practical applications and layouts. Please give full details of experience, qualifications and salary desired. Address Box No. 424, care HEATING AND VENTILATING, 148 Lafayette St., New York.

The New York Blower Company requires successful and experienced fan and unit heater salesmen. For further information address The Sales Manager, 3155 Shields Avenue, Chicago, Ill.

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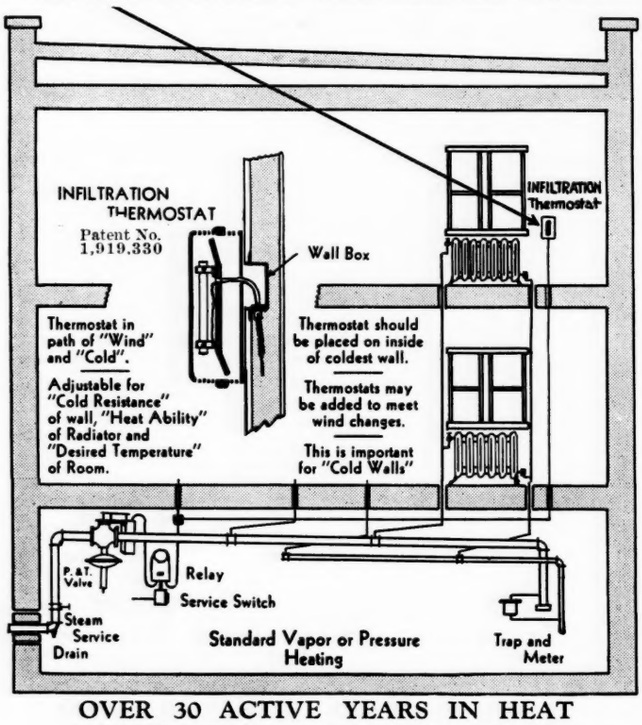
Stands Between You and the Cold


INFILTRATION THERMOSTAT
Patent No. 1,919,330
Wall Box
INFILTRATION Thermostat
Thermostat in path of "Wind" and "Cold".
Adjustable for "Cold Resistance" of wall, "Heat Ability" of Radiator and "Desired Temperature" of Room.
Thermostat should be placed on inside of coldest wall.
Thermostats may be added to meet wind changes.
This is important for "Cold Walls"
P. & T. Valve
Relay
Service Switch
Steam Service
Drain
Standard Vapor or Pressure Heating
Trap and Meter

OVER 30 ACTIVE YEARS IN HEAT DISTRIBUTION IS AT YOUR SERVICE

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RIC-WIL IRON CONDUIT
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is waterproofed, thus keeping steam pipes dry and maintaining the highest thermal efficiency. Write for complete details.

Tile Ric-wiL, Type F, with three pipes.

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Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

AIR COOLING AND DRYING SYSTEMS
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Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago.

AIR ELIMINATORS
Sarco Co., Inc., New York, N. Y.

AIR FILTERS
Staynew Filter Corp., Rochester, N. Y.

BOILER—OIL BURNER UNITS
Petroleum Heat & Power Co., Stamford, Conn.

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Spencer Heater Co., Williamsport, Pa.

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BOILERS, HEATING, STEEL COAL-FIRED
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CORK, INSULATING
Armstrong Cork & Insulation Co., Lancaster, Pa.

COVERING, BOILER, PIPE, ETC.
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(See Regulators, Damper)

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(Continued on Page 64)

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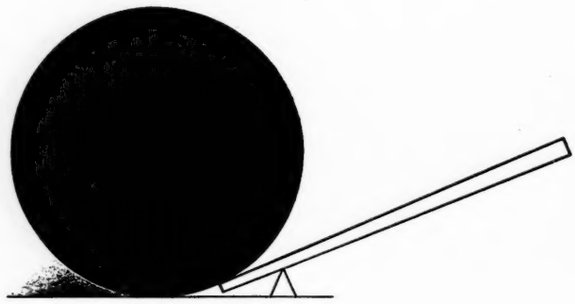

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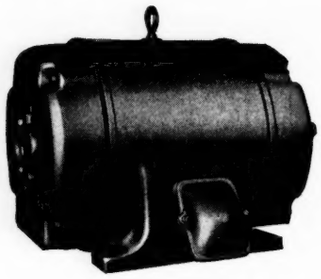

SPLASH PROOF
Indoors—Outdoors

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Johnson Service Co., Milwaukee
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National Regulator Co., Chicago

HUMIDITY CONTROL
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National Regulator Co., Chicago

INSULATION, BOILER, PIPE, ETC.
(See Covering, Boiler, Pipe, etc.)

MECHANICAL DRAFT APPLIANCES
(See Draft Appliances, Mechanical).

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American Sheet & Tin Plate Co., Pittsburgh, Pa.
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Youngstown Sheet & Tube Co., Youngstown, Ohio

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PIPE, WROUGHT IRON
Byers Co., A. M., Pittsburgh, Pa.

PRESSURE REDUCING VALVES
(See Regulators, Pressure)

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Nash Engineering Co., So. Norwalk, Conn.

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Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago

REGULATORS, TEMPERATURE
(See Temperature Control)

SHEET METAL (See Metal, Sheet)

STEAM TRAPS
(See Traps, Steam, etc.)

STEEL SHEETS, COPPER BEARING AND GALVANIZED
American Sheet & Tin Plate Co., Pittsburgh, Pa.
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STEEL STRIP
Inland Steel Co., Chicago, Ill.

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Sarco Co., Inc., New York, N. Y.

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STRAINERS, WATER
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National Regulator Co., Chicago
Raymond Co., F. I., Chicago, Ill.
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TRAPS, RADIATOR
Sarco Co., Inc., New York, N. Y.

TRAPS, RETURN
Sarco Co., Inc., New York, N. Y.

TRAPS, STEAM
Davis Regulator Co., Chicago
Sarco Co., Inc., New York, N. Y.

TRAPS, VACUUM
Sarco Co., Inc., New York, N. Y.

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VALVES, AIR RELIEF
Davis Regulator Co., Chicago
Sarco Co., Inc., New York, N. Y.

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Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

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Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

VALVES, NON-RETURN
Davis Regulator Co., Chicago

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Barber-Colman Co., Rockford, Ill.
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York, N. Y.

VALVES, PRESSURE REDUCING
(See Regulators, Pressure)

VALVES, REGULATING
Barber-Colman Co., Rockford, Ill.
Davis Regulator Co., Chicago
Hornung, J. C., Chicago, Ill.
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Sarco Co., Inc., New York, N. Y.

VALVES, RELIEF (WATER)
Davis Regulator Co., Chicago, Ill.

VALVES, STOP AND CHECK
(See Valves, Non-Return)

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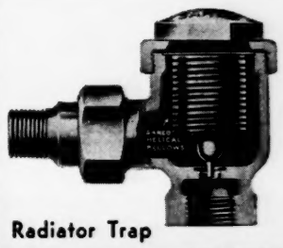
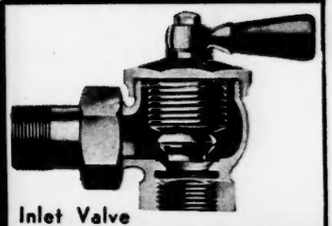
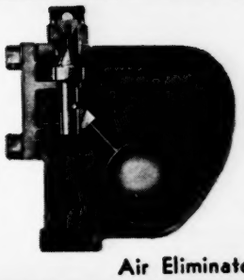
SARCO
HEATING SYSTEMS
are built to a quality standard


Radiator Trap

SARCO Radiator Trap
Keeps radiators thoroughly drained. Prevents air binding and waste of live steam. Noiseless.

SARCO Packless Inlet Valve
No packing used. Leakage impossible. Quick opening. Made of cast brass, heavily nickeled.

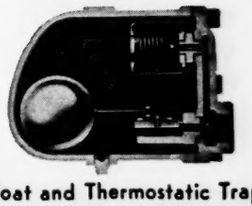

Inlet Valve


Air Eliminator

SARCO Air Eliminator
Vents air at one central point in basement. Prevents air being drawn into system when under vacuum.

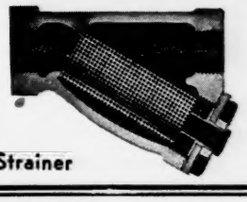
SARCO Alternating Receiver
Returns condensate to boiler automatically. Prevents low water level damaging boiler.

Alternating Receiver


Float and Thermostatic Trap

SARCO Float and Thermostatic Trap
Removes condensate which cannot be handled fast enough by thermostatic means alone. Cannot air bind.

SARCO Strainer
Is self-cleaning. Prevents dirt and scale from getting into and damaging valves, traps, etc.


Strainer

Write for Catalog P-45

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183 Madison Avenue **New York, N. Y.**
Branches in Principal Cities
Sarco Canada Limited, Federal Building
Toronto, Ont., Canada

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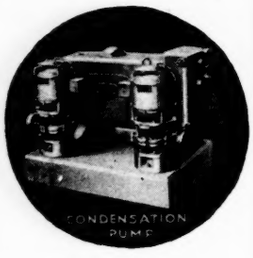

BULLETIN 800

BULLETIN 700

AMES NRA MEMBER U.S. WE DO OUR PART PUMPS

DISTINCTIVELY DIFFERENT

Because—

In designing Ames Pumps, the prime consideration of Ames engineers is, and always has been, to make quality an inherent feature that is expressed in advanced design, workmanship, and above all—pump performance.

A most important, but secondary matter, is the exceptionally attractive price that puts these quality pumps on a very favorable competitive basis.

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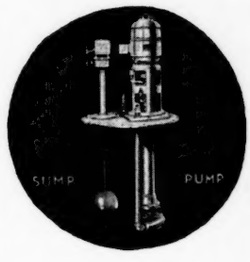
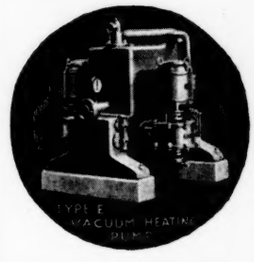
Division of American Locomotive Company
Representatives in all principal cities. Products manufactured and sold in Canada by Montreal Locomotive Works, Ltd.

BULLETIN 1100



BULLETIN 1200



BULLETIN 600

1930	1931	1932	1933

For Us—Years of Progress

from which You will continually Profit

FOR more than a third of a century, Spencer Heater Company has forged ahead continuously—pioneering, developing and improving Low Cost Automatic Heat. During the past four years, in spite of adverse general conditions, Spencer's steady advance has never halted. Spencer representatives have been kept at their work. Spencer branch offices have been established in the Middle West. Spencer's Engineering and Research program has continued at a greater rate than ever before. New Spencer products have been introduced. Each step forward that Spencer has taken has been with the object of increasing the Convenience, Comfort and Economy of Automatic Heat for a still greater number of people. Spencer Heater Company appreciates that a great measure of the success it has achieved is due to the enthusiastic assistance rendered by representative heating contractors in impressing building owners with the exclusive advantages of Spencer Automatic Heat. Keeping this ever-growing number of aggressive heating contractors constantly in mind, Spencer Heater Company pledges itself to a continuance of its progress in the year that is ahead with a program that offers still greater opportunity for members of the heating trades.

SPENCER HEATER COMPANY, Williamsport, Pennsylvania

Division of Cord Corporation

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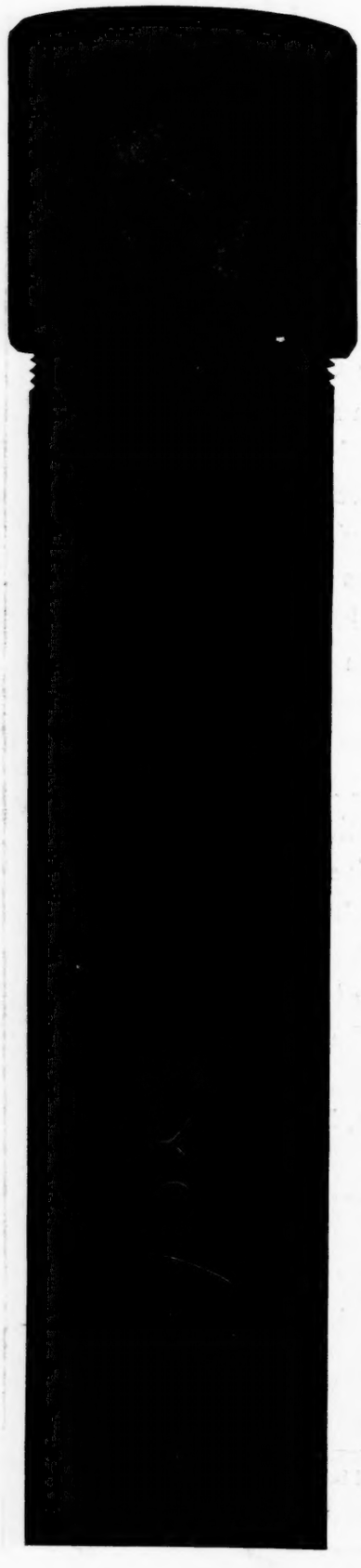
Magazine Feed
BOILERS
for steam, vapor or hot water

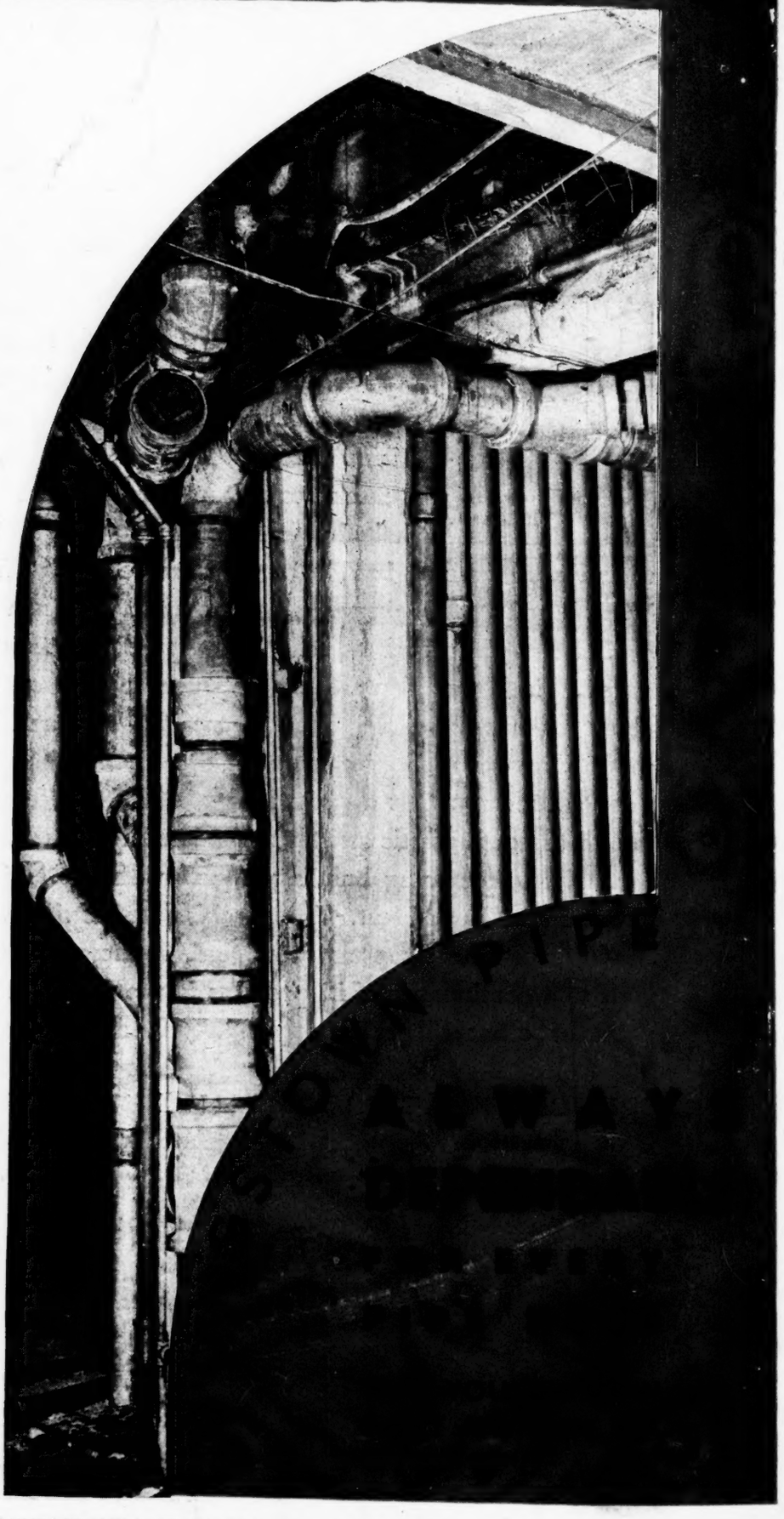
SPENCER STEEL TUBULAR BOILERS
(Magazine Feed)
Combination fire tube and water tube.
Capacities, 275 to 16,400 sq. ft.

SPENCER OIL BURNING STEEL BOILER
Highest heating efficiency, with any standard make oil burner.
Capacities, 2250 to 40,000 sq. ft.

SPENCER STOKER BOILER UNIT
Steel boiler and stoker, built as a unit, automatically controlled.
Burns cheap grades of coal, smokelessly.

YOUNGSTOWN





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